OIS-AIR PROJECT

Establishment of the Open Innovation System of the Adriatic-Ionian Region

DT 1.1 – PILOT OF ADRIATIC-IONIAN MACRO-REGIONAL SMART SPECIALISATION STRATEGY

Macro-Regional Smart Specialisation Strategy

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Macro-Regional Smart Specialisation Strategy of Adriatic-Ionian Region

Strategy document

PART II

March 2019
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OIS-AIR is implemented through the financial support of the ADRION programme.

Abbreviations

- AAL: Ambient Assisted Living
- AC: Alternating current
- ADRION: Interreg Programme of Adriatic-Ionian region
- AI: Artificial intelligence
- AIR: Adriatic-Ionian region
- AMIF: Asylum, Migration and Integration Fund
- AP: Action Plan
- AR: Augmented reality
- BMVI: Federal Ministry of Transport and Digital Infrastructure
- CAGR: Compound annual growth rate
- CEF: Connecting Europe Facility
- CF: Cohesion Fund
- COSME: Competitiveness of Enterprises and Small and Medium-sized Enterprises
- CSP: Concentrated solar power
- DER: Decentralizes energy resources
- DG MARE: Directorate-General for Maritime Affairs and Fisheries
- DG NEAR: Directorate-General for Neighbourhood and Enlargement Negotiations
- DG REGIO: Directorate-General for Regional and Urban Policy
- DG: Directorate-General
- EDP: Entrepreneurial Discovery Process
- EDs: Economic Domains
- EIB: European Investment Bank
- EMFF: European Maritime and Fisheries Fund
- ERDF: European Regional Development Fund
- ESF+: European Social Fund Plus
- ESIF: European Structural and Investment Funds
- EUSAIR: EU Strategy for the Adriatic and Ionian Region
- EVs: Electric vehicles
- FP7: Framework Programme 7
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
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<tbody>
<tr>
<td>GB</td>
<td>Governing Board</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>GERD</td>
<td>Gross domestic expenditure on R&amp;D</td>
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<tr>
<td>GHG</td>
<td>Greenhouse gas</td>
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<tr>
<td>GVCs</td>
<td>Global value chains</td>
</tr>
<tr>
<td>H2020</td>
<td>Horizon 2020</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and communication technology</td>
</tr>
<tr>
<td>IoMT</td>
<td>Internet of medical things</td>
</tr>
<tr>
<td>IoT</td>
<td>Internet of Things</td>
</tr>
<tr>
<td>IPA</td>
<td>Instrument for Pre-accession Assistance</td>
</tr>
<tr>
<td>ISF</td>
<td>Internal Security Fund</td>
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<tr>
<td>KETs</td>
<td>Key Enabling Technologies</td>
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<tr>
<td>MRS3 AIR</td>
<td>Macro-Regional Smart Specialization Strategy of Adriatic-Ionian Region</td>
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<td>MRS3</td>
<td>Macro-Regional Smart Specialization Strategy</td>
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<tr>
<td>MRSs</td>
<td>Macro-Regional Strategies</td>
</tr>
<tr>
<td>MRSTPA</td>
<td>Macro-Regional Sub-Thematic Priority Area</td>
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<tr>
<td>MRTPA</td>
<td>Macro-Regional Thematic Priority Area</td>
</tr>
<tr>
<td>NABS</td>
<td>Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets</td>
</tr>
<tr>
<td>NACE Rev.2</td>
<td>Statistical Classification of Economic Activities in the European Community Rev. 2</td>
</tr>
<tr>
<td>NIPACs</td>
<td>National IPA (Instrument for Pre-Accession Assistance) Coordinators</td>
</tr>
<tr>
<td>NUTS 2</td>
<td>Nomenclature of Territorial Units for Statistics 2 level</td>
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<td>Open Innovation System of the Adriatic-Ionian Region</td>
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<td>POs</td>
<td>Policy Objectives</td>
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<td>Project partners</td>
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<td>PV</td>
<td>Photovoltaic</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and development</td>
</tr>
<tr>
<td>R&amp;I</td>
<td>Research and innovation</td>
</tr>
<tr>
<td>RDI</td>
<td>Research, development and innovation</td>
</tr>
<tr>
<td>RIS3</td>
<td>Research and Innovation Strategies for Smart Specialisation</td>
</tr>
<tr>
<td>S3</td>
<td>Smart Specialisation Strategy</td>
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<td>S3P</td>
<td>Smart Specialisation Platform</td>
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OIS-AIR is implemented through the financial support of the ADRION programme
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<td>Software as a service</td>
</tr>
<tr>
<td>SDG</td>
<td>Sustainable Development Goals</td>
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<td>SDs</td>
<td>Scientific Domains</td>
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<tr>
<td>SMEs</td>
<td>Small and medium enterprises</td>
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<tr>
<td>SNA</td>
<td>Social network analysis</td>
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<tr>
<td>STPA</td>
<td>Sub-Thematic Priority Area</td>
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<tr>
<td>TPA</td>
<td>Thematic Priority Area</td>
</tr>
<tr>
<td>TSGS</td>
<td>Thematic Steering Groups</td>
</tr>
<tr>
<td>VBC</td>
<td>Value-based care</td>
</tr>
<tr>
<td>VR</td>
<td>Virtual reality</td>
</tr>
<tr>
<td>WBIF</td>
<td>Western Balkan Investment Framework</td>
</tr>
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1. Introduction

Pilot Macro-Regional Smart Specialisation Strategy of Adriatic-Ionian Region (MRS3 AIR) is a document envisioned to set a framework for supporting and strengthening macro-regional innovation system within the project of broader scope: “Establishment of the Open Innovation System of the Adriatic-Ionian region” (OIS-AIR).

OIS-AIR project is an INTERREG project that pursues the final goal of establishing the Open Innovation System of the Adriatic-Ionian Region (OIS-AIR), a single marketplace for technology and innovation competitive and attractive at macro-regional level. OIS-AIR intends to strengthen the development of industrial and entrepreneurial activities within a virtuous circle involving relevant stakeholders from different sectors in Adriatic-Ionian region, from research institutions to SMEs and public administration.

In particular, the project will:

1. improve skills and competencies of R&D centres in stimulating the creation of innovation networks beyond borders;
2. stimulate SMEs access to research infrastructures and facilities and increase business investments in R&I, with a specific focus on those sectors characterizing the competitive advantage of the region;
3. valorise research results and establish durable links and synergies between enterprises, R&D centres and research infrastructures.

The OIS-AIR approach is based on a Hub & Spoke scheme integrating two operational levels: local and transnational. Locally established Innovation Centres scout research results, gather SMEs needs, promote opportunities. At transnational level the Hub coordinates Centres’ activities and acts as a gate matching demand and offer of services and research results, offering specialized services and infrastructures.

OIS-AIR unlocks the innovation potential of the Adriatic-Ionian region as a whole by:

1. generating the first macro-regional Smart Specialisation Strategy dedicated to the Adriatic-Ionian region aimed at defining key macro-regional development trajectories based on regional S3;
2. creating a Hub&Spoke innovation network to support organizational and physical facilities open to research and companies;
3. developing the OIS-AIR Hub, a web-based portal, an area for knowledge, innovation, technology, initiatives and opportunities exchange developed and operated by its users and beneficiaries;
4. delivering specialized innovation services to SMEs, such as technology and innovation audits carried out by local Innovation Centres;
5. organizing a Proof of Concept Call to valorise research-based innovation;
delivering innovation vouchers to support the best trans-regional research-driven innovation projects developed jointly by research Institutions and SMEs embedded into the pilot Adriatic-Ionian S3.

MRS3 document is divided into two parts. First part describes results in general and key elements of the strategy including basic explanation of used concept and strategy framework. The second part of the document provides more detailed description chosen MRTPAs together with the description of methodology, policy framework and tools that were used to identify the chosen MRTPAs. Project team created methodology in order to focus on common thematic priority areas that are the most frequent among S3 documents and closely interrelated with EU Strategy for the Adriatic and Ionian Region (EUSAIR) pillars and challenges. These five proposed Macro-Regional Thematic Priority Areas (MRTPA) with associate Macro-Regional Sub-Thematic Priority Areas (MRSTPA) are:

1. Agro-Bioeconomy – Healthy and functional food (Blue) – emphasis on seafood (including freshwater food)
2. Energy and Environment – Integration of distributed energy resources (DER)
3. Transport and Mobility – Green coastal & maritime mobility
4. Tourism and Culture – Smart and creative upgrade of cultural tourism

Besides frequency and their ability to tackle regional challenges identified in EUSAIR, identified MRTPA for MRS3 AIR were additionally tested and confirmed by analysing participation in Global and Macro-Regional Value Chains (GVCs) together with the Macro-Regional R&D networks and cooperation within them.

Pilot Macro-Regional Smart Specialization Strategy of Adriatic-Ionian region (MRS3 AIR) defines key macro-regional development trajectories based on regional S3 and EUSAIR by exploring opportunities for complementarities and common R&D specialisations in the Adriatic-Ionian macro-region. Pilot MRS3 AIR will serve as a basis for the establishment of the OIS-AIR and is designed in a way to assure continuity and flexibility considering the forthcoming evaluation process and possible changes within the regional and national S3.

The macro-regional dimension in S3 is expected to provide a wider choice of actors, areas and expertise for the R&I partnerships in the discovered priority areas and together with the OIS-AIR platform could be the missing link to promote wide range of collaboration and funding opportunities in the AIR area.
2. Methodology

The main goal is to identify, classify, extract and develop new concept of MRTPAs of mutual interest based on diverse 33 national/regional S3 strategies, across the defined AIR region, which is as aligned as possible with the EUSAIR.

Identified MRTPAs and their narrowed sub-areas (Macro-Regional Sub-Thematic Priority Areas – MRSTPAs) would present areas of greater economic growth potential and synergies for stakeholders cooperation on macro-regional level based on their economical, innovation and R&D specialised competences.

Figure 1 MRS3 concept

The developed methodology includes the following key steps:

1. collecting data on S3 thematic priority areas (TPAs) from Eye@RIS3 tool;
2. classifying all collected TPAs into 20 predefined, broader and coherent thematic priority areas termed Macro-Regional Thematic Priority Areas (MRTPAs);
3. identifying five MRTPAs common to all AIR countries/regions based either on their highest frequency and/or firm association with pillars and topics of EUSAIR;
4. analysis and comparison of relevant S3 TPAs data based on inputs from three data categories: Economic Domains (EDs), EU Policy Objectives (POs) and Scientific Domains (SDs);
5. for each of five chosen MRTPAs, most appropriate Macro-Regional Sub-Thematic Priority Area (MRSTPA) is defined based on TPA descriptions, composition of ED (NACE Rev. 2), PO and SD data and their frequency and association with EUSAIR pillars and topics;
6. anticipating megatrends and analysing recurring keywords, KETs, R&D networks and data from previous steps to propose MRSTPA subtopics and a set of solutions containing interconnected and interrelated topics for innovation and R&D;
7. aligning all elements into a strategy by stating purpose and vision for the MRS3, missions, and goals for each of the five MRSTPAs.
2.1 General analysis preconditions and steps

For the collection and identification of diverse thematic priority areas in the AIR region project team used Eye@RIS3 tool database which has been developed by the European Commission as a tool that offers critical information to support European territories in prioritising investments and collaboration.

Figure 2 Eye@RIS tool


Eye@RIS3 tool analysis is an essential step for analysis and benchmarking MRTPA process, representing a prerequisite for identifying MRSTPAs with relevant subtopics. Total of 33 national or regional S3 across defined AIR region members comprise of 204 diverse TPAs mostly consisting of various thematic heterogeneous classifications specific to each S3.

Figure 3 Visual depiction of methodology

Source: Authors
Funnel concept is used by applying several filtering steps in order to achieve homogenous and uniform starting point for further and more detailed analysis. Therefore, of utmost importance was to classify 204 diverse TPAs into broader categories of common priorities, i.e. grouping them under common denominators. Using recent work on comparative analysis of the national S3 in Central Europe\(^1\), and supplemented by additional AIR specifics project goals, list of 20 common MRTPAs was created.

**Table 1 List of MRTPAs**

<table>
<thead>
<tr>
<th>No.</th>
<th>MRTPA CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ENERGY &amp; ENVIRONMENT</td>
</tr>
<tr>
<td>2</td>
<td>ICT &amp; ELECTRONICS</td>
</tr>
<tr>
<td>3</td>
<td>HEALTH &amp; MEDICINE</td>
</tr>
<tr>
<td>4</td>
<td>AGRO-BIO ECONOMY</td>
</tr>
<tr>
<td>5</td>
<td>TRANSPORT &amp; MOBILITY</td>
</tr>
<tr>
<td>6</td>
<td>ELECTROTECHNICAL AND MECHANICAL SYSTEMS</td>
</tr>
<tr>
<td>7</td>
<td>ADVANCED MANUFACTURING SYSTEMS</td>
</tr>
<tr>
<td>8</td>
<td>NEW MATERIALS</td>
</tr>
<tr>
<td>9</td>
<td>LIFE SCIENCE</td>
</tr>
<tr>
<td>10</td>
<td>SECURITY</td>
</tr>
<tr>
<td>11</td>
<td>TOURISM &amp; CULTURE</td>
</tr>
<tr>
<td>12</td>
<td>BIOTECHNOLOGY</td>
</tr>
<tr>
<td>13</td>
<td>SMART CITIES AND COMMUNITIES</td>
</tr>
<tr>
<td>14</td>
<td>CONSULTANCY</td>
</tr>
<tr>
<td>15</td>
<td>NANOTECHNOLOGY</td>
</tr>
<tr>
<td>16</td>
<td>WOOD TECHNOLOGIES</td>
</tr>
<tr>
<td>17</td>
<td>CHEMICAL TECHNOLOGY</td>
</tr>
<tr>
<td>18</td>
<td>PHOTONICS</td>
</tr>
<tr>
<td>19</td>
<td>BLUE ECONOMY</td>
</tr>
<tr>
<td>20</td>
<td>OTHER</td>
</tr>
</tbody>
</table>

Source: Authors, based on Radosevic, S., Walendowski, J. (2016), op. cit.

Having narrowed down a total number of 204 heterogeneous TPAs into 20 more homogenous classes called MRTPAs, the next step was to narrow them further into five thematic areas in relation to:

1. Frequency (count).
2. Thematic connection with four EUSAIR pillars and related topics (Blue Growth, Sustainable Tourism, Connecting the Region and Environmental Quality).
3. Prevailing character of the MRTPA depending on whether it is a solution type (desired option due to possibility for better and easier integration of stakeholders) or a technology type MRTPA. Technology areas are often horizontally aligned, e.g. KETs and can be used to support solution-based areas.

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\(^1\) Radosevic, S., Walendowski, J. (2016), *A prospective comparative analysis of the national Smart Specialization Strategies in Central Europe: Expert assessment of synergies and areas of potential cooperation related to Smart Specialization Strategies in Central Europe*, http://s3platform.jrc.ec.europa.eu/documents/20182/81824/S3-CE_160926_report.pdf/491bbe6f-7610-4960-a74c-b8a57a0c9f4, retrieved: 15.1.2019
Funnelling and aligning the process results in identification of four MRTPAs (Agro-Bioeconomy; Energy and Environment; Tourism and Culture; Health and Medicine) identified as most frequent areas across AIR region, and some of them with additional strong connections with EUSAIR pillars and topics. The last MRTPA Transport and Mobility was selected due to alignment with all three preconditions firstly by strong connection with EUSAIR pillars and topics and then by being characterized as solution-based area together with additional (non-conditional but important) high economic prospect based on global macro trends and tendencies backed up by recent Horizon Europe R&D foresight – BOHEMIA study\(^2\). Several areas were omitted from selection due to their technology type character opposed to selected solution type thematic areas, e.g. ICT (focused horizontal thematic area), New materials, Advanced manufacturing systems (KETs characteristics), Smart Cities and Communities (not related to EUSAIR pillars and topics) or undefined themes (Other).

\(^2\) Horizon Europe R&D foresight – BOHEMIA study is the main EU strategic foresight study in support of the Commission’s proposal for Horizon Europe - the EU framework programme for research and innovation 2021-2027, European Commission,https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-eu-research-and-innovation-policy-making/foresight/activities/current/bohemia_en, retrieved: 15.1.2019
Figure 5 AIR MRTPA distribution

Figure 5 represents distribution of all AIR MRTPAs as a result of homogenization of initial 204 TPAs. Rounded number represents frequency, i.e. the number of TPAs that are classified and converted into MRTPAs.

2.2 Analysis aiming at MRSTPA identification

Identification of top five MRTPAs preceded the more challenging step in order to identify common macro-regional sub-thematic areas or MRSTPAs. MRSTPAs are more focused and narrowed down areas including several technology and solution subtopics.

The analysis is based on the following data set inputs: Economic Domains (NACE Rev. 2 codes), Policy Objectives and Scientific Domains, TPA keywords, descriptions, R&D excellence, frequency and association with EUSAIR pillars and topics.
OIS-AIR Pilot of Adriatic-Ionian MRS3

Table 2: Pilot OIS-AIR analytical table

For each of the top five MRTPAs the process of determining frequencies and identifying the most common parameters of Economic Domains (EDs), Policy Objectives (POs) and Scientific Domains (SDs) has followed. Table 3 provides an example of MRTPA Energy and Environment with the most frequent identified activities and their corresponding codes under each domain, e.g. most frequent Economic Domains (EDs) were D.35 (Electricity, gas, steam and air conditioning supply), E.38 (Waste collection, treatment and disposal activities; materials recovery) and M.72 (Scientific research and development). Regarding Scientific Domains (SDs) most frequent were 05.37 (Renewable energy sources), 05.33 (Energy production and distribution efficiency) and 05.32 (Energy efficiency - consumption). In Policy Objectives (POs) J.68 (Sustainable energy & renewables), J.71 (Waste management) and J.63 (Eco-innovations) are most frequent POs.
As a final step, under each MRTPA, by anticipating megatrends, corresponding KETs, TPA keywords, descriptions, R&D excellence data, EUSAIR correlation and other available analysed data from previous steps, individual MRSTPA can be identified along with corresponding subtopics proposed as a set of solutions containing interconnected and interrelated subjects for innovation and R&D.

2.3 Methodology validation example

Introduction

For the purpose of methodology validation, a step-by-step example based on country/region perspective is presented, with a goal to show relative position of national or regional S3 strategies with proposed MRS3 and corresponding MRTPA and MRSTPA areas.

Validation example follows the developed methodology key steps:

1. collecting data on S3 thematic priority areas (TPAs) from Eye@RIS3 tool;
2. classifying all collected TPAs into 20 predefined, broader and coherent thematic priority areas termed Macro-Regional Thematic Priority Areas (MRTPAs);
3. identifying five MRTPAs common to all AIR countries/regions based on their highest frequency and/or firm association with pillars and topics of EUSAIR;
4. analysis and comparison of relevant S3 TPAs data based on inputs from three data categories: Economic Domains (EDs), EU Policy Objectives (POs) and Scientific Domains (SDs);

Source: Authors

### Table 3 MRTPA Energy and Environment most frequent Economic Domains, Scientific Domains and Policy Objectives

<table>
<thead>
<tr>
<th>ED code</th>
<th>Frequency</th>
<th>SD code</th>
<th>Frequency</th>
<th>PO code</th>
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</table>

f(Economic Domains) f(Scientific Domains) f(Policy Objectives)
5. for each of five chosen MRTPAs, most appropriate Macro-Regional Sub-Thematic Priority Area (MRSTPA) is defined based on TPA descriptions, composition of ED (NACE Rev. 2), PO and SD data and their frequency and association with EUSAIR pillars and topics;

6. anticipating megatrends and analysing recurring keywords, KETs, R&D networks and data from previous steps to propose MRSTPA subtopics and a set of solutions containing interconnected and interrelated topics for innovation and R&D;

7. aligning all elements into a strategy by stating purpose and vision for the MRS3, missions, and goals for each of the five MRSTPAs.

**Step 1** and **Step 2** represent initial prerequisite technical and one-time analytical steps common to any region/country across the AIR region, explained in methodology section of the document.

**EXAMPLE – Friuli-Venezia Giulia / MRTPA Agro-Bioeconomy**

Region Friuli-Venezia Giulia was chosen within pilot group with the focus on MRTPA Agro-Bioeconomy.

**Figure 6 Methodology key steps**

Source: Authors

**Step 3:** Identifying five MRTPAs common to all AIR countries/regions based either on their highest frequency and/or firm association with pillars and topics of EUSAIR
Friuli-Venezia Giulia’s regional S3 themes, were grouped into 5 (out of 20) aligned technology priority areas based on its description, i.e. Tourism and Culture, Advanced Manufacturing Systems, Blue Economy, Health and Medicine, and Agro-Bioeconomy. Marked in red are 3 MRTPA Friuli-Venezia Giulia’s areas identified within top five MRTPAs with highest frequency among all AIR’s S3 strategies, i.e. Tourism and Culture, Health and Medicine, and Agro-Bioeconomy.

**Step 4:** Analysis and comparison of relevant S3 TPAs data based on inputs from three data categories: Economic Domains (EDs), EU Policy Objectives (POs) and Scientific Domains (SDs)

Source: Authors

Each of three main categories (EDs, SDs, POs) is sub-divided in order to collect more precise information regarding specific activities and embedded with corresponding aligned MRTPA.

**Step 5:** Finding common sub-areas within top five MRTPAs that are more focused and narrower. Those sub-areas are based on keywords, descriptions, composition of ED, PO and SD data and their frequency and association with EUSAIR pillars and topics. Sub-areas are called Macro-Regional Sub-Thematic Priority Areas (MRSTPA).

Having found corresponding EDs, SDs and POs within Agro-Bioeconomy, (Figure 9) data is further analysed.
The following table represents MRTPA Agro-Bioeconomy with the most frequent identified activities based on frequencies compared to major data set of all regional/national TPAs and their frequency and association with EUSAIR pillars and topics (Table 4).

**Table 4 Agro-Bioeconomy frequency of Economic Domains, Scientific Domains and Policy Objectives**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Frequency</th>
<th>Domain</th>
<th>Frequency</th>
<th>Objective</th>
<th>Frequency</th>
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</table>

Source: Authors
Data analysis shows that region compared with overall regions frequency results, has 5 hits in EDs, 4 hits in SDs and 4 hits in POs. All hits are placed within top 10 most frequent EDs, SDs and POs activities. These include: C.10 (Food products); J.62 (Computer programming, consultancy and related activities); 08.76 (Food productivity and technology); 06.41 (Manufacture of food products); J.61 (Bioeconomy); G.48 (Food security & safety).

Further analysis requires structured keywords originating from regional/national S3 strategies including the EUSAIR strategy.

Analysis of future KETs (document Re-finding Industry)³ and future BOHEMIA study scenarios⁴ in order to identify appropriate connections with suggested MRSTPA is the essential step.

**Figure 10 Keywords and future KETs**

Source: Authors; European Commission, Directorate-General for Research and Innovation (2018), op. cit. (Authors’ edit)

**Step 6:** Anticipating megatrends and analysing recurring keywords, KETs, R&D networks and data from previous steps to propose MRSTPA subtopics and a set of solutions containing interconnected and interrelated topics for innovation and R&D.

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OIS-AIR is implemented through the financial support of the ADRION programme

OIS-AIR Pilot of Adriatic-Ionian MRS3

Figure 11 MRSTPA Healthy and functional food (Blue) – emphasis on seafood (including freshwater food) and corresponding subtopics and their impact

Source: Authors

Based of methodology approach, analysis shows that Friuli-Venezia Giulia region has strongpoint in at least two out of three suggested and identified MRSTPA subtopics, i.e. Advanced processing and packaging solutions and Food safety and traceability making that region a strong and suitable candidate for future collaboration within OIS-AIR members. Smart solutions for personalised diet subtopic bearing solution-based character may be exploited in most regions including Friuli-Venezia Giulia region as well.

Step 7: Aligning all elements into a strategy by stating purpose and vision for the MRS3, missions, and goals for each of the five MRSTPAs

Purpose: Strengthen the regional innovation system and spark smart growth through cross-regional collaboration, thereby responding to priorities, challenges and opportunities of the Adriatic-Ionian region.

Vision: Established and competitive transnational value chains in Adriatic-Ionian region created by deploying complementary resources and infrastructure and fostering innovation in S3 areas of common interest.

- Friuli-Venezia Giulia region is a competent and suitable collaboration candidate aligned in its strategic directions with above analysed MRSTPA and may contribute to the accomplishment of the purpose and vision of MRS3 and its members.

MRSTPA Healthy and functional food (Blue) – emphasis on seafood (including freshwater food)

- Mission: Fresh and safe Mediterranean diet delivered from its source.
- Goals: Creating and securing sustainable value chain based on regional fresh seafood marketed for healthier lifestyle.

- Friuli-Venezia Giulia region may actively serve defined MRSTPA mission and goals due to mostly overlapping thematic areas between regional and MRS3 activities and present itself as a suitable candidate for collaboration within AIR region.
3. Policy framework

For the purpose of the pilot MRS3 AIR, project team used a number of the macro-regional, national and regional policy documents that are relevant for the identification of the mutual MRTPA and relevant keywords for each MRTPA.

These documents are:

1. **EUSAIR** – is a macro-regional strategy adopted by the European Commission and endorsed by the European Council in 2014. The Strategy was jointly developed by the Commission and the Adriatic-Ionian region countries and stakeholders, which agreed to work together on the areas of common interest for the benefit of each country and the whole region.

2. **Smart Specialisation Strategies (S3) and other relevant documents** – project team used S3 documents from the partner organization regions in order to define first set of mutual areas and keywords (pilot group) which were later compared with the other TPAs defined in the rest of the S3 documents from the Adriatic-Ionian region (through the Eye@RIS3 Tool).

Regions/countries involved in the pilot group:

1. **Italy (regional S3)**
2. Friuli-Venezia Giulia
3. Basilicata
4. **Greece (regional S3)**
5. Region of Central Macedonia
6. **Croatia (national S3)**
7. **Slovenia (national S3)**

Other relevant documents (where S3 is still under development):

1. **Serbia** - Regional Mapping Report
2. **Albania** – relevant documents are in the process of development, therefore the project team resorted to the use of Eye@RIS3 Tool)

The following chapters represent all relevant policy documents together with the rest of the data, tools and methodology in more details.
4. About the EUSAIR

The EU Strategy for the Adriatic and Ionian Region (EUSAIR) is one of the four macro-regional strategies that European Commission adopted and which are endorsed by European Council. EUSAIR is conceived through collaboration of the Commission and the Adriatic-Ionian region countries and stakeholders. The strategy brought forward agreement among stakeholders on mutual collaboration on the areas of common interest, which agreed to work together on the areas of common interest for the benefit of each country and the whole region.

The EUSAIR general objective states: “to promote economic and social prosperity and growth in the region by improving its attractiveness, competitiveness and connectivity.” Considering that Adriatic-Ionian region consists of four EU member countries and four non-EU countries, the strategy aims to contribute to further and deeper integration of Western Balkans into EU.

As already mentioned, The EUSAIR covers eight countries: four EU Member States (Croatia, Greece, Italy, Slovenia) and four non-EU countries (Albania, Bosnia and Herzegovina, Montenegro, Serbia).

Countries implementing EUSAIR agreed on areas of mutual interest with high relevance for the Adriatic-Ionian countries themselves and the region as a whole. Strategy itself is founded on four pillars, which, simultaneously, pose challenges that the region is facing and opportunities for accelerated growth and integration of the region (Figure 12).

*Figure 12 EUSAIR pillars and topics*

| Topic 1 – Blue technologies |
| Topic 2 – Fisheries and aquaculture |
| Topic 3 – Maritime and marine governance and services |

| Topic 1 – The marine environment |
| Topic 2 – Transnational terrestrial habitats and biodiversity |

| Topic 1 – Maritime transport |
| Topic 2 – Intermodal connections to the hinterland |
| Topic 3 – Energy networks |

| Topic 1 – Diversified tourism offer (products and services) |
| Topic 2 – Sustainable and responsible tourism management (innovation and quality) |


---

In the following section, pillars and objectives of the EUSAIR are laid out as they are presented in the European Commission document:

1) Pillar 1: Blue Growth

The specific objectives for this pillar are:

1. to promote research, innovation and business opportunities in blue economy sectors, by facilitating the brain circulation between research and business communities and increasing their networking and clustering capacity;

2. to adapt to sustainable seafood production and consumption, by developing common standards and approaches for strengthening these two sectors and providing a level playing field in the macro-region;

3. to improve sea basin governance, by enhancing administrative and institutional capacities in the area of maritime governance and services.

To achieve the abovementioned objectives, Pillar 1 will focus on three topics:

1. Topic 1 – Blue technologies

2. Topic 2 – Fisheries and aquaculture

3. Topic 3 – Maritime and marine governance and services.

2) Pillar 2: Connecting the Region

The specific objectives for this pillar are:

1. to strengthen maritime safety and security and develop a competitive regional intermodal port system;

2. to develop reliable transport networks and intermodal connections with the hinterland, both for freight and passengers;

3. to achieve a well-interconnected and well-functioning internal energy market supporting the three energy policy objectives of the EU – competitiveness, security of supply and sustainability.

To achieve the abovementioned objectives, Pillar 2 will focus on three topics:

1. Topic 1 – Maritime transport

2. Topic 2 – Intermodal connections to the hinterland


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OIS-AIR is implemented through the financial support of the ADRION programme
3) Pillar 3: Environmental Quality

The specific objectives for this pillar are:

1. to ensure a good environmental and ecological status of the marine and coastal environment by 2020 in line with the relevant EU acquis and the ecosystem approach of the Barcelona Convention;

2. to contribute to the goal of the EU Biodiversity Strategy to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restore them in so far as feasible, by addressing threats to marine and terrestrial biodiversity;

3. to improve waste management by reducing waste flows to the sea and, to reduce nutrient flows and other pollutants to the rivers and the sea.

Two topics are identified as pivotal in relation to environmental quality in the Adriatic-Ionian region:

1. Topic 1 – The marine environment
2. Topic 2 – Transnational terrestrial habitats and biodiversity.

4) Pillar 4: Sustainable Tourism

The specific objectives for this pillar are:

1. diversification of the macro-region’s tourism products and services along with tackling seasonality of inland, coastal and maritime tourism demand;

2. improving the quality and innovation of tourism offer and enhancing the sustainable and responsible tourism capacities of the tourism actors across the macro-region.

To achieve the abovementioned objectives, Pillar 4 will focus on two topics:

1. Topic 1 – Diversified tourism offer (products and services)
2. Topic 2 – Sustainable and responsible tourism management (innovation and quality).

4.1. EUSAIR governance and management architecture

At the time of initial setup of EUSAIR implementation framework, importance of the “good and stable governance mechanisms” were stressed as, “crucial for effective implementation.”\(^7\) Furthermore, it was pointed out that “governance in macro-regional strategies is not about new funds nor bureaucracy, but how and by whom the strategies are implemented and joint actions initiated and financed.”\(^8\) Moreover, it was concluded that “governance must have both a political and operational dimension, with line ministries and implementing bodies setting strategic objectives, and then making sure the work is strictly followed up.”\(^9\)

\(^7\) EUSAIR, https://www.adriatic-ionian.eu/about-eusair/governance/, retrieved: 15.1.2019
\(^8\) Ibid.
\(^9\) Ibid.
Additionally, operational dimension of the EUSIAR strategy implementation framework consists of two main levels:

- the coordinating level represented by a Governing Board
- implementation level represented by Thematic Steering Groups.

Effective support to both operational levels is provided by the EUSAIR Facility Point strategic project. Below are to a greater extent explained duties and obligations of the aforementioned bodies that represent operational dimension of EUSAIR implementation as they are presented in European Commission document.\(^{10}\)

**EUSAIR Governing Board (GB)**

The Governing Board (GB) coordinates the work of the Thematic Steering Groups in charge of implementation through strategic guidance with respect to management and implementation of the EUSAIR and its Action Plan. To this end, representatives from the participating countries should be duly empowered by their respective Governments.

GB’s functions should include:

1. acting as interface between the operational/managerial level (Thematic Steering Groups) and the political/ministerial level;
2. convening and preparing meetings at ministerial level, as appropriate;
3. proposing possible revisions of the Strategy and/or the Action Plan;
4. issuing strategic guidelines to the Thematic Steering Groups (TSGs) and ensuring linkages between them;
5. issuing guidelines on information and publicity about the Strategy;
6. reporting to the EU-28 High Level Group on macro-regional strategies;
7. elaborating further, and reviewing as appropriate, on the six broad criteria, included in the Action Plan (AP), for selecting actions/projects as potential candidates for inclusion in the AP;
8. providing a general template for Rules of Procedures governing the TSG;
9. providing orientations and guidelines for the annual EUSAIR Forum (e.g. setting the Agenda);
10. ensuring coordination with existing regional cooperation organizations, as appropriate;
11. developing a monitoring and evaluation framework The GB should adopt its Rules of Procedures.

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Participants:

1. national representatives: each participating country is represented by two delegates, one from the Ministry of Foreign Affairs, the other from the national authorities responsible for the coordination EU funds (in non-EU countries: National IPA Coordinators);

2. Pillar Coordinators;

3. Commission services (DG REGIO, DG MARE and DG NEAR). Other DGs (Directorate-General) will be invited as appropriate, especially those relating to the pillars;

4. the permanent Secretariat of the Adriatic-Ionian Initiative;

5. a representative of the Committee of the Region's Adriatic-Ionian Interregional Group;

6. a representative of the European Economic and Social Committee;

7. the Managing Authority of the ADRION programme and the authority responsible for the EUSAIR Facility Point under that programme.

The GB can consider inviting other participants, as appropriate. The GB will be co-chaired by the country chairing pro tempore the Adriatic and Ionian Initiative and by the Commission (DG REGIO).

Thematic Steering Groups (TSGs)

The EUSAIR Communication identifies four interdependent pillars of strategic importance: Pillar 1 – Blue Growth; Pillar 2 – Connecting the Region (transport and energy networks); Pillar 3 – Environmental Quality; Pillar 4 – Sustainable Tourism. It is proposed to set up one Thematic Steering Group per pillar. However, special arrangements will be set under Pillar 2 (transport and energy).

The TSGs will be chaired for an initial period of 3 years by a tandem of countries, on a rotating basis, starting with those that acted as coordinators for the pillar of their choice during the consultation process, namely: Greece and Montenegro for Pillar 1, Italy and Serbia for Pillar 2, Slovenia and Bosnia and Herzegovina for Pillar 3, and Croatia and Albania for Pillar 4. These arrangements may be reconsidered in due course by the Governing Board, as appropriate.

TSGs’ functions should include:

1. developing specific criteria for selecting actions/projects within each pillar on the basis of the six broad criteria included in the Action Plan (AP) as further developed/complemented by the Governing Board, as appropriate;

2. identifying actions/projects to be included in the AP, ensuring that they comply with the pillars’ objectives, including with regard to cross-cutting and horizontal aspects;

3. identifying relevant funding sources for the actions/projects selected and facilitating and following up implementation of actions/projects, including monitoring and evaluation;

4. ensuring linkages with the other thematic Steering Groups;

5. liaising with Managing Authorities/NIPACs3 of EU programmes in EU and non-EU countries;
6. liaising with: the relevant EU programmes managed directly by the Commission; the IFIs; the regional cooperation organisations, etc.;

7. convening and preparing meetings of relevant line ministers;

8. submitting to the GB policy proposals and recommendations revisions of the AP;

9. reporting to the GB.

Each TSG is to adopt its Rules of Procedures on the basis of the template provided by the GB.

Each country is to ensure that the necessary internal consultations are completed prior to TSG meetings so that the position adopted by its representatives in the TSG reflects a compromise acceptable to all key actors, within the country, that are concerned by the issues discussed.

Participants:

1. Chairs. Each TSG will be chaired by two Pillar Coordinators following the scheme presented above. These Coordinators will be designated by the respective countries from their most competent national/regional administrations. Coordinators shall, i.a. ensure the necessary interaction with the other TSGs.

2. Members. In each TSG: Representatives from the relevant administrations within the participating countries. Sub-national (regional) representatives should participate, as appropriate, according to each country’s institutional structure.

3. The Commission, including relevant line DGs.

4. Regional cooperation organisations, as appropriate.

5. Representatives of International Financial Institutions, as appropriate.

The Pillar Coordinators can consider inviting other participants.

4.2. Role of the Adriatic-Ionian (ADRION) transnational cooperation programme

It was recognized that “operational and administrative support is of utmost importance for an effective and efficient performance of the functions attributed to the GB and the TSGs,” and that “the ADRION programme shall support governance and implementation of the EUSAIR through Priority Axis "Supporting the governance of the EUSAIR" which envisions a specific Action "Operational support to the key EUSAIR governance actors and stakeholders in their respective role".\(^{11}\)

Furthermore, it was decided that, “this Action – which will be implemented through a EUSAIR Facility Point to be established in the Slovenian administration” and may include following activities:\(^{12}\)

1. providing day-to-day operational and logistic support to the GB and TSGs;

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\(^{11}\) European Commission (2014b), op. cit.

\(^{12}\) Ibid.
2. assisting the TSGs in ‘match making’ activities, bringing together project promoters and financiers;

3. providing assistance in developing project concepts (seed money, pilot actions, preparatory actions, etc.);

4. supporting preparation of macro-regional actions/projects, in coordination with the TSGs;

5. supporting the TSGs in monitoring, reporting and evaluation;

6. facilitating the development and functioning of a stakeholders platform;

7. facilitating visibility through promotion of an Adriatic-Ionian profile, as well as awareness-raising, including management of a EUSAIR website and the staging of events (incl. the annual EUSAIR Forum);

8. assisting the GB in the preparation of the annual EUSAIR Forum;

9. supporting the building of the knowledge base, including collection of reliable and comparable data for establishing sound baselines and developing relevant, evidence-based result indicators and plausible targets;

10. facilitating dialogue with bodies in charge of the implementation of programmes/financial instruments regarding how best to mobilize funding for actions under the different pillars.

*Figure 13 Different levels, members and support of EUSAIR governance*

<table>
<thead>
<tr>
<th>Level</th>
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<th>Implementation</th>
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<tr>
<td>Support</td>
<td>EUSAIR Facility Point</td>
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</table>

Source: Authors
4.3 Funding sources – possibilities for the EUSAIR financing

Financial resources needed for implementation of “The Action Plan of the Strategy” shall be allocated by mobilising and aligning all available EU, international, national and private funding of relevance for the four pillars and the specific topics identified under each pillar.\(^{13}\)

Within “Regulatory framework of European Structural and Investment Funds (ESIF) for 2014-2020 and the Instrument for Pre-accession Assistance (IPA) for non-EU countries”, substantial financial assets and a wide range of tools and technical options are provided.

Furthermore, the macro-regional approach has already been included in the new generation of Regulations for the programming period 2014-2020. As Partnership Agreements and Operational Programmes for EU countries (Greece, Italy, Slovenia and Croatia) are advised to take the forthcoming MRS3 AIR into account, attention is being paid to the strategy in the current negotiation process.

In addition, due to the coordinated approach of the Directorate General for Regional and Urban Policy and the Directorate General for Enlargement, Strategy Papers for non-EU countries (Montenegro, Serbia, Bosnia and Herzegovina, Albania) will also explicitly refer to the Strategy.

Moreover, considering that the macro-regional strategy will contribute directly to national objectives, thereby becoming an integral component of national, regional and local strategies, all kinds of existing funding sources beside EU level can be harnessed, dramatically increasing funding possibilities in support of cooperation activities throughout the macro-region.

**Other funding sources**

Other means are also available. In addition to interventions of international financial institutions, the Western Balkan Investment Framework (WBIF) provides finance and technical assistance for strategic investments, particularly in infrastructure, energy efficiency and private sector development.

Capitalising on the work done in the framework of the two other macro-regional strategies on innovative financing, implementation of projects, also in the non-EU countries, can benefit from innovative options involving, among others, the WBIF.

The European Investment Bank (EIB), for its part, stands ready to mobilise its financing tools and expertise in support of suitable projects under the topics included in the Action Plan. The EIB can extend support to both public and private sector activities in the form of lending, blending and technical advice. It offers a variety of financing instruments, ranging from investment loans for both direct and indirect financing to equity funds via the European Investment Fund. An overview of how the EIB can contribute to the implementation of the Strategy for the Adriatic-Ionian region is enclosed in this document.

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\(^{13}\) EUSAIR, https://www.adriatic-ionian.eu/funding-sources/, retrieved: 15.1.2019
Specific funds for the pillars

Funds of relevance for the specific pillars are also available. The European Maritime and Fisheries Fund as well as Horizon 2020 (H2020), which targets Blue Growth as one of its focus areas for RTD, can lend key support to implementation of actions and projects under Pillar 1.

Of high relevance for Pillar 2, the Connecting Europe Facility (CEF) 2014-2020 supports the development of high-performing, sustainable and efficiently interconnected trans-European networks in the field of transport, energy and digital services. The Facility focuses on projects with high EU value-added, such as building missing cross-border links and removing bottlenecks along main trans-European transport corridors.

The CEF creates significant leverage and attracts additional public and private funding through the use of innovative financial instruments, notably EU project bonds. CEF financing for actions in pre-accession countries can be granted if these actions are necessary for implementing projects of common interest. CEF coordination with the H2020 research and innovation programme as well as with the Cohesion and Structural Funds will be central. The Commission has proposed that important parts of the budget of the ESIF for 2014-2020 be dedicated to projects related to energy, transport and ICT infrastructure.

As for Pillar 3, funds under the LIFE programme are open also to non-Member States. This programme explicitly mentions cross-border actions and includes mitigation as well as an adaptation pillar. Pillar 4 may, among others, benefit from the COSME programme for SMEs.
5. About the S3

5.1 Brief history of the S3 approach

The concept of the Smart Specialisation was formulated between 2007 – 2009 within the reformed Cohesion policy of the European Commission (EC)\(^{14}\) that aims at reducing regional disparities across EU. Initially, this new policy approach promoted “the concentration of public resources in knowledge investments on particular activities in order to strengthen comparative advantage in existing or new areas”.\(^{15}\) The policy basically promotes the transformation of regional economies by directing resources into new, knowledge-based activity domains.\(^{16}\)

At the request of Commissioner Janez Potočnik, this new policy concept was developed by a team of economists „Knowledge for Growth Group”, as a high-level advice on how to reinvigorate the Lisbon Strategy and a means to reduce the gap between EU and its counterparts.\(^{17}\) The Smart Specialisation concept was conceived as a key solution for avoiding dissipation of the EU research funds. Resources – research, innovation, human and financial, were to be focused on highly performing and socio-economically important and innovative sectors.\(^{18}\) Importantly, the new policy concept responded to main critiques of earlier regional policy interventions: lack of private sector involvement, unrealistic expectations (due to insufficient assessment of regional assets), inappropriate transfer of best practices and policies from leading regions to other regions, overlapping of promising sectors and technologies in regional strategies and insufficient focus to transregional aspects.

The mentioned group of experts suggested that national and regional governments should foster investments into selected domains that would match country’s other productive resources. The aim was to build domestic capabilities and translate regional/national strengths into regional/national comparative advantages. This approach would also allow for targeted and effective policy intervention. The proposal was integrated into the Europe 2020 Strategy, a strategy for smart, sustainable and inclusive growth that aims at overcoming structural weaknesses of the EU economy and provides a vision of Europe’s social market economy.\(^{20}\) The goals and targets set by this strategy in the field of


\(^{16}\) OECD (2013), op. cit.


\(^{19}\) Ketels, C., et al. (2013), op. cit.

Employment, R&D, Climate change and energy, Education, Poverty and Social exclusion are shared among member countries.\textsuperscript{21}

The preparation of smart specialisation strategies started in 2011, while in May 2012, the Guide of developing smart specialisation strategies was developed by authors Foray et al. in order to provide support, along with the S3 platform, in the policy design and implementation.\textsuperscript{22} Strategies based on smart specialisation concept were coined as research and innovation strategies for smart specialisation (RIS3). RIS3 can be considered “integrated, place-based economic transformation agendas”, furthermore:\textsuperscript{23}

1. they focus policy support and investments on key national/regional priorities, challenges and needs for knowledge-based development, including ICT-related measures;
2. they build on each country’s/region’s strengths, competitive advantages and potential for excellence;
3. they support technological as well as practice-based innovation and aim to stimulate private sector investment;
4. they get stakeholders fully involved and encourage innovation and experimentation;
5. they are evidence-based and include sound monitoring and evaluation systems.

Smart specialisation concept is complex in that it integrates various policy and theoretical approaches. Some key features of Smart specialisation, in particular when placed in the regional context, are:\textsuperscript{24}

1. **Place-based approach to innovation** – the concept can be placed in different special contexts. Importantly, the Smart specialisation concept requires assessment of local assets and capabilities, based on research on local sources of knowledge, value chains and external connections. Moreover, path-dependencies are acknowledged as well as competitiveness of firms and institutions within their sector.
2. **Focus on R&D and Innovation** – S3 has a strong focus to R&D and innovations, but it is not constrained to single industries or sectors. The focus is rather to cross-sectoral R&D and innovations.
3. **Cross-sectorial connections and “domains”** – S3 also uses knowledge domains as the relevant context of policy formulation. These are defined as socio-economic contexts within which innovation occurs. Thus, S3 are designed to support intra-sectorial and inter-sectorial spillovers of knowledge that occur within/between these knowledge domains. It has been recognised that knowledge spillovers occur among domains that possess “related variety”.

\textsuperscript{23}Foray et al. (2012), op. cit.
\textsuperscript{24}Ketels, C., et al. (2013), op. cit.
In other words, knowledge spillovers occur among sectors with complementary knowledge and competencies.

4. **Key role of entrepreneurial actors** – S3 concept in practice envisages cooperation of key actors in the relevant spatial context. Local entrepreneurs are seen as key in leading innovation and in the creation of new products, markets, technologies and processes, while in the broad sense, the other agents also include academia, independent innovators and consortia. The interaction between these agents can effectively lead to cooperation in creating innovation, new products and services.

5. **Critical mass and scale of activity** – entrepreneurial discovery is an essential element of S3, in that entrepreneurs are recognising promising market niches and addressing them with new products and services. The S3 concept acknowledges that entrepreneurial discovery is more likely to occur as a result of knowledge spillovers between knowledge domains where there is critical mass of actors engaged in innovation. Furthermore, chances for knowledge spillovers are better where knowledge domains are of larger scale, i.e. where this is also more interaction between agents.

In practice, formulating and adopting the RIS3 was set as an ex-ante condition for receiving funding from European Structural and Investment Funds (ESIF). The Structural Funds are the primary tool of European Commission’s Cohesion Policy for reducing socio-economic disparities between regions and Member states, as well as ensuring economic growth across Europe.\(^{25}\) Thus, Cohesion policy is also integral to the smart specialisation process.\(^{26}\) It is expected that efficient use and management of ESIF\(^{27}\) as well as a view to concentrate resources on research and innovation, will maximize the impact of funding.\(^{28}\) The latter should be ensured via RIS3 implementation. In combination with other sources of funding of investments, along with ESIF, through strengthening the innovation capacity, the economic prospects should be enhanced at both national and regional level. Measures are both horizontal (addressing the regional innovation ecosystem, regardless of economic domains), and vertically targeted (focused on a limited number of priority domains).\(^{29}\)

While most countries and regions implement RIS3 with support measures provided within their operational programmes (OPs), some have opted to implement RIS3 with additional measures outside OPs.\(^{30}\)

As a result, according to EC data, over 120 smart specialisation strategies have been developed and over EUR 67 billion of funding is earmarked to support these strategies, under ESIF and national/regional funding.\(^{31}\) Thus, RIS3 became a major political instrument of cohesion policy and for

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\(^{27}\) Komninos, N., et al. (2018), op. cit.

\(^{28}\) OECD (2013), op. cit.


\(^{30}\) Foray, D., Morgan, K., Radosevic, S. (2018), op. cit.

achieving goals of Europe 2020 strategy and it allows countries and regions to direct their resources to promising niches and activities.\textsuperscript{32} Through funding provided within national or regional OPs, it is expected that 15,000 enterprises will introduce new products to the market, 140,000 start-ups will be supported and 350,000 jobs will be created in the programming period 2014 – 2020. Additional support has been programmed under the European Social Fund for strengthening human capital in RDI in the amount of EUR 1.8 billion.\textsuperscript{33}

The depth of specialisation can be seen from the data contained in Eye@RIS3 database - since January 2017, the database contains more than 1.300 encoded smart specialisation priorities. Out of these, roughly 21 % are associated with key enabling technologies or KETs, 16.3 % are associated with Health, 15.2 % with Energy and 12.1 % with Digital Agenda.\textsuperscript{34} There are six recognised KETs of Europe. According to the Commission’s definition, KETs of Europe encompass micro/nanoelectronics, photonics, nanotechnology, industrial biotechnology, advanced materials and advanced manufacturing systems.\textsuperscript{35}

While Smart specialisation was originally envisaged as a new EU policy, countries outside EU have also taken interest in this policy concept and have recognised its value in introducing structural change and smart growth.\textsuperscript{36} These developments are favourable for EU as well as it opens up possibilities for various types of collaboration with these countries, as well as possibilities for new business and investment opportunities. An additional evident strength of Smart Specialisation arises out of implementation in non-EU countries – the concept allows customising research, innovation and other complementary policies to various contexts - including national, regional and local.\textsuperscript{37}

With this acknowledgement, the concept may be applied to EU macro-regional level as there is strong rationale: there is even a wider choice of actors and complementary resources for achieving collaboration in areas of common S3 priority domains than on a country or a regional level. EU already endorsed four macro-regional strategies (MRSs) based on the recognition that these large geographical areas have common challenges to be addressed. Similar to S3, MRSs promote bottom-up approach, and have incorporated R&D as a tool to address wellness and prosperity of MRs.\textsuperscript{38} Moreover, policy dialogue on MR collaboration in S3 areas may be built in alignment with the existing strategic framework - MRSs.


\textsuperscript{34} Ibid.

\textsuperscript{35} Foray et al. (2012), op. cit.

\textsuperscript{36} OECD (2013), op. cit.

\textsuperscript{37} Smart Specialisation Platform, http://s3platform.jrc.ec.europa.eu/events/-/asset_publisher/assets3peventscalendar/content/smart-specialisation-from-the-eu-to-the-world, retrieved: 8.2.2019

\textsuperscript{38} Smart Specialisation Platform, http://s3platform.jrc.ec.europa.eu/eu-macro-regional-strategies, retrieved: 8.2.2019
Design and implementation of RIS3 tackle both the issue of EU global competitiveness and the competitiveness of regions/countries. Investments into R&D are key to bringing innovation, yet in terms of size of these investments, Europe is lagging behind its main competitors. One of the main priorities of the Europe 2020 for Member States is to invest 3% of their GDP on research and innovation activities. Nonetheless, total gross domestic expenditure on R&D (GERD) as a share of GDP in the EU is still lower than in comparable countries such as USA, Japan and South Korea. Should trends in the R&D investment rate (measured as percentage of GDP) be continued – currently 2.2% in Europe, 3% in the US and 3% in China, Chinese R&D investments are expected to surpass the EU in terms of total expenditure already in 2022. Also, the EU has lagging behind its counterparts in transforming knowledge generated through scientific and technological achievement into innovation, new products and services. A positive fact though is that in terms of the quality of innovation and patents EU is retaining comfortable lead, along with Japan and the United States.

Figure 14 EU regional competitiveness index

Figure 15 Regional Innovation Scoreboard

Source: Regional Competitiveness Index (2016)

Source: Regional Innovation Scoreboard (2017)

On EU scale, the level of variation among regions in the context of competitiveness and innovation (Figure 14 and Figure 15), is high. GERD on national level within the EU also shows considerable variation.

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39 European Commission (2017a), op. cit.
variations among countries. Values are higher in cases of countries like Sweden, Austria and Denmark, and significantly lower in cases of Eastern and Southern European countries. The majority of well-performing innovation systems within the EU are primarily situated in more developed and highly competitive countries and regions. There is evident correlation between the R&D performance and the economic performance, resonating with the New growth theory.

The potential for reducing disparities between the leading and lagging regions/countries and for bringing about the lead in the global technology is seen in integrated research and regional policies. These policies aim at facilitating knowledge absorption and technology transfer between leading and lagging regions/countries.\textsuperscript{43} It is RIS\textsuperscript{3} design and implementation that is expected to result in strengthening of research and innovation systems in countries and regions, and then to further bring increase in knowledge flows, absorption and utilisation.\textsuperscript{44} Economic benefits are expected to accrue in all EU regions/countries from RIS\textsuperscript{3} implementation, particularly in the less developed regions. RIS\textsuperscript{3} implementation is expected to activate R&I in less developed regions and to support the industrial transition in other regions.\textsuperscript{45}

Smart specialisation agenda and the development of RIS\textsuperscript{3} are conceptually founded on previous experiences of the EC in regional innovation and on theories which explain regional growth patterns based on knowledge and innovation.\textsuperscript{46} The basic principle of Smart specialisation is that it is an approach based on analysis of strengths and national/regional economic potential, as well as on the Entrepreneurial Discovery Process (EDP). EDP with multiple stakeholders enables the identification of strategic areas for intervention in order to more efficiently focus the innovative capabilities of a country/region on the domains/sectors of the highest potential.\textsuperscript{47}

Smart specialisation brings some new principles in strategic decision making of regions and countries. Under RIS\textsuperscript{3}, countries and regions need to consider their position relative to other regions of Europe and with respect to global value chains (GVC).\textsuperscript{48} The latter carries untapped potential in that GVC has a prominent role in growth and modernisation of less developed regions and should be given more direct attention. Moreover, once that regions/countries develop sufficiently strong technological capabilities, GVC can be utilized as a path to internationalisation of economic activity and for building external linkages.\textsuperscript{49}

EDP should be elaborated as it is an important step in recognising promising niches/sectors and an integral component of the S3 methodology. The process is evidence-based and includes engagement of stakeholders and attention to market dynamics.\textsuperscript{50} These stakeholders come from various environments, such as government, business and academia and are engaged in an interactive bottom-
up process with the purpose of recognising promising sectors for investment and future competitiveness.\textsuperscript{51} EDP can be outlined in five main steps:\textsuperscript{52}

1. selecting areas meeting a critical threshold for productive activities;
2. exploring productivity gaps and using alternative paths for productive diversification taking inter-, multi- and trans-disciplinary combinations and technologies into considerations;
3. evaluating possible scenarios by entrepreneurs and experts;
4. prioritising assessed scenarios weighing the value-added benefit;
5. experimenting with small-scale pilot initiatives before full-scale implementation.

\textit{Figure 16 Five main steps for smart entrepreneurial discovery}


With respect to RIS3 goals, too broad definitions of priority areas should be avoided as they will lead to supporting the projects that are thematically scattered and critical mass might not be generated, nor spillovers or other desired effects such as increased scale and scope. Instead, priority areas should be narrowly defined, so that supported projects are better connected and can bring synergies.\textsuperscript{53}

To summarize, the development and implementation of RIS3 strategies consists of six iterative phases, which are to be implemented in close collaboration between the public authorities, academia, business community and innovation users (i.e. through the quadruple helix approach). This approach ensures that the synergic effects are utilised. The role of the private sector is to discover and produce information about new RDI activities targeting promising niches, while the role of the public sector is to provide the supporting conditions for innovation deployment and for bringing the results to markets.\textsuperscript{54}

The six phases are:\textsuperscript{55}

1. \textbf{Governance} – the initial phase, includes government and stakeholder engagement. The key result of this phase is the development of bases for S3 process.
2. \textbf{Analysis of the context} – includes collection of background information; a thorough analysis of regions’ position compared to global competition, also its potential for transformation.
3. \textbf{Strategy formulation} – future development paths are examined through dialogue with key stakeholder for the region; shared vision and future scenarios for the region are formulated.
4. \textbf{Priority setting} – includes selection of priority areas of RIS3 in a region/country, the key criteria being the ability to create critical mass on these areas and build competitiveness.

\textsuperscript{51} Komninos, N., et al. (2018), op. cit.
\textsuperscript{52} Ibid.
\textsuperscript{53} Foray, D., Morgan, K., Radosevic, S. (2018), op. cit.
\textsuperscript{54} On-line S3 Platform, http://www.s3platform.eu/how-to-form-ris3/, retrieved: 1.2.2019
\textsuperscript{55} Ibid.
5. **Policy mix** – refers to defining action plan for each selected priority area of RIS3; the action plan is the main document of implementation of RIS3.

6. **Monitoring and evaluation** – in this phase that is used to observe and evaluate the success in the implementation of the action plan. It is indicators as well as target values that are that will allow for evaluation of the success of the programme. Regions and countries should also observe the development of conditions such as political, economic, social and technological conditions. When necessary, the action plan should be adjusted and, also, the RIS3 process can be re-started.

All of these phases can be assessed consecutively, or parallel to each other.

![Figure 17 Six phases of Smart Specialisation strategies](source: On-line S3 Platform, http://www.s3platform.eu/how-to-form-ris3/, retrieved: 1.2.2019)

RIS3 implementation requires strong institutional capacities due to the fact that Smart specialisation is a complex policy concept. These institutional resources should enable investments into projects that will bring about results that can be brought to (niche) markets, also, institutional resources are expected to trigger an uptake of innovation.\(^{56}\) This task requires transformation and upgrading of the public leadership model. Institutional capacities are found to be of upmost importance for RIS3 implementation. However, institutional conditions do vary across EU greatly. Moreover, institutional capacities may represent significant hindrance to effective RIS3 implementation.\(^{57}\)

In managing RIS3 implementation, the public sector should consider three factors/topics:\(^{58}\)

1. **Leadership** – RIS3 requires a shift from governmental (i.e. centralised) to collaborative (i.e. decentralised) type of governance.
2. **Leadership knowledge** – RIS3 requires more granular knowledge of sectors and industries of governments and its partners.
3. **Policy integration** – unexploited potential is seen in integrating public procurement into the RIS3 policy mix so as to drive the demand side for innovative products and services.

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\(^{56}\) European Commission (2017a), op. cit.

\(^{57}\) Foray, D., Morgan, K., Radosevic, S. (2018), op. cit.

\(^{58}\) Ibid.
Notably, the public body which is formulating RIS3 strategy is dealing with two main issues – that of differentiation and of specialisation. Differentiation is accomplished in that each region/country should identify their own specific capacities and opportunities, compared to other regions, which are promising in terms of bringing about significant benefits if developed further. This process actually allows for development of distinctive and original areas of specialisation where resources can be directed due to potential for scale, scope and knowledge spillovers (which act as productivity drivers). This concentration of activities reduces the problems that arise from fragmentation and duplication of efforts and R&D in and between EU countries and regions that would otherwise subsequently diminish the potential for complementarities within the European knowledge base. To the contrary, the main expected effect of the new policy is increased diversification among regions and countries and effectiveness on the EU level.

RIS3 is a policy process (rather than a policy), which is being realised through a set of policies that are in some of their dimensions related to innovation and technology. RIS3 serves as interface among different policies: industrial policy, R&D policy, Cohesion policy, Grand challenges policy and European value chains and networking initiatives. The integrative role is accomplished by including elements of RIS3 into related national/regional policies, so that harmonisation of policies is ensured. Also, the implementation of RIS3 that includes various agencies and ministries which manage their sector specific programmes and programmes framed under RIS3. Consequently, RIS3 has the power to configure other policies to some extent and create synergies.

**Figure 18 The relationship between the RIS3 and five main policy domains**

The policy coordination that is provided through RIS3 design and implementation as well as the cursor role of RIS3 among different policy domains is necessary to maximize the impact of innovation deployment.\textsuperscript{63}

Implementation of RIS3 is underway and managed by national or regional authorities in close cooperation with key stakeholders such as universities, industry and social partners, accompanied by an ongoing, continuous EDP. The concept of innovation under RIS3 is broad rather than just R&D-orientated or based on technological activities.\textsuperscript{64} RIS3 is a pronouncedly experimental as a policy process. It is envisaged as open for adaptation and a flexible concept. In practice, this allows for characteristics of the programme within priorities and priorities themselves to be modified. For example, priorities can be discontinued and new ones can be introduced. These modifications can be based on results of EDP and on the results of policy monitoring.\textsuperscript{65} This should be acknowledged as RIS3 does not automatically guarantee success.\textsuperscript{66} Notably, ongoing EDP as well as an effective and efficient revision mechanism of RIS3 are needed to ensure effective and efficient implementation.

### 5.3 Current developments and challenges

The current state of affairs in Europe shows that its economic future relies on the future of its regions. On the one hand, it must continue to sustain the progress of its most competitive regions, as they are the engine running the prosperity of the whole of Europe, and on the other, to decrease the regional divergence between such areas and those lagging behind and industrial transition regions.

Although RIS3 represent a strong tool of Cohesion policy, as pointed out, they should rather be perceived as a place-based innovation process, thereby acknowledging their impact onto other innovation-related policies.\textsuperscript{67} It is considered that RIS3 has proven to be quite successful in encouraging interaction of stakeholders, enabling more efficient functioning of multi-level governance, as well as facilitating the processes of planning and execution of innovation strategies, especially in more developed regions.

Evidence shows that smart specialisation strategies have influenced national and regional innovation systems in the context of the following aspects: \textsuperscript{68}

1. **Governance and institutional changes** – new practices in public administrations with regard to innovation policy-making have been developed and RIS3 approach had brought significant structural and institutional changes in regional governance by strengthening interdepartmental cooperation, participative and inclusive governance and a more transparent and efficient monitoring mechanism.

\textsuperscript{63} Foray, D., Morgan, K., Radosevic, S. (2018), op. cit.
\textsuperscript{64} Hegyi, F. B., Rakhmatullin, R. (2017), op. cit.
\textsuperscript{65} Foray, D., Morgan, K., Radosevic, S. (2018), op. cit.
\textsuperscript{66} On-line S3 Platform, op. cit.
\textsuperscript{68} European Commission (2017a), op. cit.
2. **The Entrepreneurial Discovery Process** – stakeholder interaction has proved conductive to opening up new market and technological opportunities, as well as informing governments’ policy and decision-making processes. The EDP approach facilitates the establishment of public-private partnerships and larger-scale projects, which indicates that the S3 concept has become an influential instrument for place-based innovation driven growth.

3. **Monitoring** – implementation of smart specialisation in numerous regions and Member States has resulted in development of a set of result-oriented policy actions, whose capacity to meet strategic objective is required to be monitored closely. Therefore, a substantial effort has been made to extend monitoring activities in order to establish connections between a range of strategic functions and the goal of better informing the decision-making process as well as adequate level of the stakeholders’ engagement.

4. **Economic transformation, new technologies and market opportunities** – the RIS3 logic facilitated a reflection on economic transformation of a wide range of regions, as it promotes locally driven knowledge-based growth and integration between research and economic development. Furthermore, unhinged entrepreneurial discovery process facilitated cross-sectoral cooperation and the development of clusters, which fosters stakeholder commitment and collaboration.

5. **Cooperation** – given the fact that RIS3 is focused on the identification of niches, clusters of related industries, cross-sectoral innovation, and value chain linkages, collaboration is fostered through identifying potential advantages in international markets as well as partners which are capable of helping to deliver new solutions and solve common challenges. The collaboration is facilitated within all triple-helix stakeholders, i.e. policymakers, academia and industry.

In order to maximise the efficiency and effectiveness of RIS3 implementation, in 2011 European Commission initiated a Smart specialisation platform with the aim to provide advice and make know-how broadly accessible to EU countries and regions in terms of design and implementation of their RIS3, primarily in the context of providing guidance material and good practice examples, informing strategy formation and policy-making, facilitating peer-reviews and mutual learning. Since its inception, the S3 Platform facilitated mutual learning, data gathering and networking opportunities for 18 EU Member states, 179 EU regions, 6 Non-EU countries and 16 Non-EU regions. Although indisputably helpful, such assistance via learning from best practices is limited in securing structural changes. This is because less developed regions should also have put in place preconditions allowing for good practices to occur as well as have the capacity to implement it. This brings us to challenges encountering RIS3 which impede reaping wider benefits in its implementation.

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namely, all the aforementioned guidance proved to be insufficient to change the mindset of regional and national authorities in the context of strategic planning for innovation and quality design of RIS3 which is primarily the case in less developed regions.70

According to Foray, Morgan and Radosevic,71 the current S3 approach suffers from several deficiencies, which prevent it from having an effective impact on structural change and technological upgrading, specifically in less-developed regions, both for public and private stakeholders. Even though there is substantial evidence of good practice, the results so far have been decidedly uneven. Deficiencies in RIS3 implementation have been found in various aspects, such as the gap between theory and methods of implementation, delegation of power from central control to bottom-up participation, weaknesses in the mobilisation and engagement of stakeholders, lack of evaluation and monitoring mechanisms. The common policy challenges that emerge concerning strengthening the impact of S3 are:72

1. further reform of research and innovation systems within regions;
2. increasing interregional cooperation in research and innovation;
3. focusing more on less developed and industrial transition regions;
4. exploiting synergies and joint work among various EU policies, initiatives and programmes.

Ultimate tenet of all RIS3 is to provide and enable regional economic development, which goes beyond R&D-based growth or R&I excellence. In order to achieve this goal, various modes of development-enabling activities are vital, and surpass pure R&D. These include human capacities in terms of skills building and gaining specific knowledge, taking up already invented technologies and upgrading or adjusting them, management practices, securing parallel performance of KETs and traditional sectors,

71 Foray, D., Morgan, K., Radosevic, S. (2018), op. cit.
72 European Commission (2017a), op. cit.
and finally recognizing and fostering social innovations.\textsuperscript{73} This shows that smart specialisation has become a crucial instrument of fostering not development \textit{per se} but fostering development relative to particular territories. It relies heavily on assets of regions, tapping into local potential in order to make places more competitive and innovative. This concept of place-based development reinforces the standard thinking which attests that factors on which the foundations of regional development are based are predominantly territorial.

In contrast to Framework Programme (H2020), S3 is not a general or spatially insensitive policy instrument, but strongly adheres to specific local context of EU regions and has therefore been instrumental in place-based development. Its priorities rely strongly on different \textbf{territorial strengths pertinent to each region}, as well as on the remaining regional context such as development status, governance and sustainability and effectiveness of the innovation eco-system. Existing developmental policies tackling innovation issues tend to alternate amongst two types of place-related ones, namely place-based and spatially-blind policies; consulted exclusively, they have both proven to be inefficient in securing growth and productivity. This has resulted with some policy makers suggesting new developmental paradigms such as “place-sensitive distributed development policies” (PSDDP),\textsuperscript{74} which are based on maximising distributed development capabilities and remaining sensitive to the characteristics, features and conditions of every territory.

RIS3, which is by and large the dominant paradigm of regional innovation policies in the EU, leans significantly on R&D-based innovation. However, such paradigm is not exclusive to innovation; for instance, other modes of innovation include those needed for transformation of existing knowledge into new configurations (e.g. design, engineering and associated management capabilities), and those needed for using existing knowledge in an innovation-enabling way (e.g. operating or production capabilities). These are the so-called “DEMP” (design, engineering, management and production capabilities) or DUI (doing, using and interacting) modes of innovation, i.e. non-R&D ones, which primarily allow for the deployment and diffusion of innovation.\textsuperscript{75} It is here that RIS3 plays an instrumental role: in the steps following new technology generation, namely that of innovation deployment and diffusion. This is particularly pertinent in less developed regions, where challenges arise due to lack of skills and competences of all stakeholders, lack of investments to match or supplement public funding, and lack of specialized knowledge in adjusting the tools to new socio-economical environments and rules of the game. Therefore, RIS3 as a crucial regional innovation policy framework should stem from both R&D based and other innovation modes.

In July 2017, The European Commission published a Communication on “Strengthening Innovation in Europe’s Regions: Strategies for resilient, inclusive and sustainable growth”,\textsuperscript{76} highlighting four challenges which are to be addressed in order to continue boosting smart, inclusive and sustainable growth in the upcoming programme period, which the next generation of RIS3 should encompass.

\textsuperscript{73} Foray, D., Morgan, K., Radosevic, S. (2018), op. cit.
\textsuperscript{75} Foray, D., Morgan, K., Radosevic, S. (2018), op. cit.
\textsuperscript{76} European Commission (2017a), op. cit.
Those challenges are:

1. Many of the RIS3 from the current period (2014-2020) have proved to be too self-oriented and inward looking, neglecting the role of collaboration with other regions, or of exploiting the international technology transfer possibilities. This has narrowed and limited their developmental and innovation horizons strictly onto them. Therefore, the next RIS3 should embed the notion of **outward looking innovation-led processes**, encouraging regions to **look for partners internationally and to look for, not necessarily best practices, but rather „best matches“**, especially when it comes down to less developed regions.\(^{77}\)

2. Existing abundance of various EU policies and instruments relating to development and innovation-based rationales, RIS3 being only one of them, should be aligned into a **coordinated and more joined up policymaking** instrumental for growth. Crucial for innovation generation and diffusion is exploiting the **synergies and complementarities of the wide array of the existing** EU innovation related policies (R&D-driven innovation policy, Cohesion or regional policy, European value chains and networking initiatives, Industrial policy, sectoral or grand challenges policy), but global ones as well (such as Sustainable development goals).

3. **Accelerating research and innovation in the less developed and transition regions** is of crucial importance in the upcoming period, as regional disparities occurring in many regions have to be decreased. Such, **lagging behind regions in the EU**, are also often surviving as remnants of the former, once promising, industry playing out, preventing the area from unlocking its full potential and burdening it with decaying and unmarketable industries. The forces at play here are twofold: industrial transition is still putting heavy burden on such areas (e.g. steel, coal, shipbuilding industries) while at the same time industry 4.0 is approaching, bringing with it new business paradigms and transformation of workplaces. Therefore, in order to decrease the development gap between more and less advanced regions, support in knowledge exchange must be provided. This includes capacity building and developing skills for smart specialisation, industrial transition and entrepreneurship at the regional and local levels, also addressing the institutional and administrative capacity and regulatory hurdles.

4. Strengthening and streamlining links between RIS3 design, implementation and evaluation on one hand, and capacities at disposal on the regional and MS level on the other, especially in less developed and industrial transition regions, is to be more advanced. **The uptake of public administration capacities needed to support the RIS3 implementation process should be enhanced and the general support for the process stepped up, and the arena of actors involved should be expanded.**

Current available data regarding the impact of S3 approach suggests that RIS3 functions better primarily in advanced EU regions, where a critical mass of implementing organisations already exists.\(^{78}\) However, the real challenges are reflected in its application to less-developed regions. In conclusion,


the following table provides an overview of positive impacts RIS3 had on innovation systems and challenges which were identified in the current programming period during design and implementation phases of RIS3.

**Figure 20 Perceived impact and identified challenges of RIS3**

<table>
<thead>
<tr>
<th>Positive impact</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. development of novel innovation policy-making policies;</td>
<td>1. the phases of RIS3 design were not adequately followed;</td>
</tr>
<tr>
<td>2. structural and institutional changes in governance with an impact on cooperation, participation and inclusiveness of stakeholders;</td>
<td>2. robustness of methodological approaches varied, and in many cases key concepts of various RIS3 steps were not fully understood;</td>
</tr>
<tr>
<td>3. implementation of EDP which had an effect on creating new market and technological opportunities and facilitated the establishment of public-private partnerships and larger-scale projects;</td>
<td>3. online tools for designing RIS3 were not adequately utilized;</td>
</tr>
<tr>
<td>4. extended monitoring activities which improved the process of informing and decision-making as well as engagement of stakeholders;</td>
<td>4. insufficient policy guidance to change the mind-set of regional and national authorities in strategic planning for innovation</td>
</tr>
<tr>
<td>5. facilitating economic transformation, discovering new technologies and market opportunities;</td>
<td>5. evident gap between theory and implementation</td>
</tr>
<tr>
<td>6. creation of clusters of correlated sectors, improved cross-sectoral innovation and encouraging value-chain linkages, all of which fostered collaborative activities between public and private partners.</td>
<td>6. delegation of power from central control to bottom-up participation.</td>
</tr>
<tr>
<td>7. weaknesses in mobilisation and engagement of stakeholders, especially societal stakeholders;</td>
<td>7. uneven impact of RIS3 throughout the EU.</td>
</tr>
</tbody>
</table>

Source: Komninos et al. (2018), op. cit.

**5.4 Future role of RIS3 in the programming period 2021 – 2027**

In May 2018 European Commission proposed to modernise Cohesion Policy for the next programming period 2021-2027. The main features of the Commission’s proposal are defined within four elements:79

1. **A focus on key investment policies, where the EU is best placed to deliver** – a large portion of European Regional Development Fund (ERDF) and Cohesion Fund (CF) are planned to go towards **innovation**, support to **small business**, digital technologies and industrial modernisation, with the emphases on the shift towards a low-carbon, circular economy as well as climate change adaptation.

2. **A Cohesion Policy for all regions and a more tailored approach to regional development:**

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OIS-AIR Pilot of Adriatic-Ionian MRS3

a) **Investing in all regions** – continuation of investing in all regions, including those still lagging behind in terms of growth or income, as well as the ones struggling to achieve industrial transition, fight unemployment and compete in globalised economy.

b) **A tailored approach** – implementation of new criteria (beside GDP per capita), including youth unemployment, education level, climate change and migrant integration, to reflect a better reality and overview of disparities between regions, which will then help to **reduce the gap between the EU regions and countries**.

c) **Locally-led** – supporting **locally-led development strategies**, which will enable local, urban and territorial authorities to be more involved in the management of EU funds.

3. **Fewer, clearer, shorter rules and a more flexible framework:**

a) **Simplifying access to funds** – less complex rules and lighter control procedures for business and entrepreneurs.

b) **A single rulebook** – one set of rules will cover 7 EU funds implemented in partnership with Member States, which will facilitate EU funds programming, and establish more efficient links with between the funds (ERDF, CF, ESF+, EMFF, ISF, AMIF, BMVI).

c) **Adapting to needs** – Combining the stability necessary for long-term investment planning with the right level of flexibility to cope with unforeseen events.

4. **A strengthened link with the European Semester to improve the investment environment in Europe,** which will enable a creation of a growth- and business-friendly environment in Europe, as well as both EU and national investment to deliver their full potential.

Unlike the current programming period, the next one will see multiple ex-ante conditionalities for ERDF support in place, called enabling conditions. They will consist of conditions some of which were acknowledged in the earlier period as well, but have now become explicit requirements. It is expected that they will not be a one-off but will apply and be assessed throughout the process. These include: 80

1. up-to-date analysis of bottlenecks for innovation diffusion, including digitalisation;
2. existence of competent regional/national institution or body, responsible for the management of the smart specialisation strategy;
3. monitoring and evaluation tools to measure performance towards the objectives of the strategy;
4. effective functioning of EDP;
5. actions necessary to improve national or regional research and innovation systems;
6. actions to manage industrial transition;
7. measures for international collaboration.

Among other novelties expected to be introduced in the new programming period, two are particularly pronounced regarding research and innovation policy: a new instrument, namely the „**Interregional Innovation Investments**“, intended to encourage the commercialisation and scaling up of innovation projects conducted jointly among regions. This should result in stronger interregional cooperation and building up of joint European value chains. Second novelty represents a greater emphasis being put onto **investments into intangible assets**, moving forward from physical assets such as equipment,

machinery and buildings. The reason lying behind it is primarily that the scope of innovation to be deployed will significantly arise from knowledge-based capital, such as improving skills set and education of human capital, market development, organisational practices and R&D expenditures, which are found to be vital for productivity and economic growth.

Finally, one thing is inherent when addressing innovation activities within EU regional landscape, that of having different development levels in different EU regions. Depending on the level of region’s development, as well as level of its R&D capacity for technology generation and general level of region’s technology diffusion and innovation deployment maturity, drivers of its productivity growth will differ. Policy replies will need to react accordingly and employ adequate mechanisms, R&D based growth being only one of them. This has come under the radar recently, in the “Lamy report”, authored by the High Level Group and chaired by Pascal Lamy at the invitation of EC, which investigated potential perspective of research and innovation policy in the EU in the next programming period. The Report drew up strategic recommendations needed to maximise the impact of future EU research and innovation programmes, highlighting (solely) R&I excellence and putting aside territorial and place-based paradigms, therefore excluding non-R&D based innovation models, which are predominantly to be found in less developed and transition regions.

An important remark needs to be introduced here, namely that the differentiation between Cohesion and H2020 policy rationales regarding innovation comes down to how critical and imperative is its implementation. RIS3 tackles technology absorption, diffusion and innovation deployment as a push for economic development on the ground, whereas H2020 primarily targets knowledge and technology generation, and only then addresses technology diffusion and innovation deployment. This is a clear divide between the two, emphasizing developmental differences among regions.

Being part of the Cohesion policy, RIS3 has a clear objective to contribute to the overall goal of the Cohesion policy, which is regional economic development of all EU regions. In order to do so, focusing solely on the research and innovation activities as a means to contribute to the productivity and growth in the EU is bound to prove insufficient. A robust policy mix taking into account other non-R&D modes of innovation (e.g. doing-using-interacting; product and process engineering improvements; practices focused on production capabilities; management practices) is better positioned to serve this goal. Strong R&I modes of innovation on the other hand do have a say in contributing to Framework programme (H2020) goal, which is research and innovation excellence, therefore narrower than the Cohesion policy one.

Cohesion policy underpinned by ESIF is strongly focused on place-based development, whereas H2020 is a general and pan-European programme, irrelevant to local conditions. Synergies and complementarities between the two should therefore be heavily exploited in the upcoming period, as only in this manner can they yield substantial economic and R&I development and growth in EU

regions. This means RIS3 advancing from technology deployment towards creating its own, regional, set of R&I criteria, and H2020 taking into account those scientifically superior projects which provide locally adjusted solutions and can be deployed locally.
6. Eye@RIS3 Tool

In order to support European regions and countries in developing RIS3s the European Commission has set up the Smart Specialisation Platform (S3P). The S3P has developed a number of online tools that facilitate gathering the innovation related information across Europe. The Eye@RIS3 tool offers critical information to support European territories in prioritising investments and collaborating. Its underlying database contains the smart specialisation priorities as indicated by EU Member States and regional administrations as well as the research and innovation priorities of several non-EU countries and regions. Eye@RIS3 is an online database to help strategy development and implementation. Data comes from a number of sources, such as from the national and regional public managers as well as from European Commission staff encoding the data based on the approved RIS3 documents. In the case of non-EU countries, existing national and regional innovation strategies are the source. In very few cases, the data on envisaged priorities are based on S3P RIS3 Peer Review Workshops and expert reports. The ultimate aim of this open tool is that the regional/national authorities regularly update their RIS3 priorities in this tool accordingly with their respective on-going stakeholder involvement processes (Entrepreneurial Discovery Processes). It is important to note that the encoded information for the non-EU countries are much more general as they have not developed as yet their RIS3 strategies, therefore the encoded information for these entities are much more general and may serve only for providing a general outlook into their R&I priorities.

The S3/R&I priorities in Europe are defined in the tool through the following three categories:

1. "Economic Domains" categories are based on the Eurostat’s NACE Rev. 2 sectoral codes and OECD categories.

2. "Scientific Domains" categories are based on the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007).

3. "EU Policy Objectives" category is composed of ten EU-wide policy areas – each with a set of various sub-categories - corresponding to the so called 'Societal Grand Challenges' identified in H2020 and the headline policies in the Innovation Union Flagship Initiative, including Creative and Cultural Industries, KETs, Social Innovation and the Digital Agenda.

The three categories aim to provide an overview of the R&I activities, in which combined investments of the EU, national, regional public and private resources are likely to stimulate knowledge-driven growth. The tool also combines and aligns the identified regional/national economic and R&I capabilities with the EU wide policy objectives.
7. Value chain analysis and Smart Specialisation Strategy in Adriatic-Ionian region

In past decade, analysis of Global value chains has become a standard tool for assessing the global economic flows. GVCs are predominantly “driven by multinationals in the pursuit of increased efficiency”, and “international production is increasingly organized within GVCs in which the production process spans several countries. The emergence of GVCs has challenged the traditional view of world trade and has required the European Union to adapt its trade and development policies, to ensure that they effectively address all of the interplaying issues in a world economy in which production has become increasingly fragmented internationally, while at the same time being tightly linked in global value chains.”

Moreover, “For many countries, especially low-income countries, the ability to effectively insert into GVCs is a vital condition for development. This supposes an ability to access GVCs, to compete successfully and to “capture the gains” in terms of national economic development, capability building and generating more and better jobs to reduce unemployment and poverty.”

On the other hand, S3, since its inception, has developed a solid footing as a concept and policy tool for managing RDI development among EU countries (to a certain extent due to a fact that serves as a precondition for funding RDI projects from EU funds). Furthermore, S3 as a concept is based on fundamental assumption of scarcity of resources (capital, human capital, etc.), which as a consequence leads to focusing on a selected number of priorities, in which, country/region/macro-region sees its opportunity to increase its competitive edge in global market. By bringing together excellence in R&D and entrepreneurial activities, S3, promises to deliver just that.

Therefore, “each country/region should be able to identify relevant linkages and flows of goods, services and knowledge revealing possible patterns of integration with partner regions. This is important in the case of both developed and for less developed countries/regions that would often require to source know-how and technology from elsewhere. In this context the significance and role of GVCs merit consideration. The position of businesses within global value chains in this respect is a crucial element to be considered. This type of analysis is particularly important as the S3 concept warns against 'blind' duplication of investments in other European regions. Any such blind duplication of efforts could lead to excessive fragmentation, loss of synergy potential, and ultimately could hamper the reach of the critical mass required for success. On the contrary, interregional collaboration should be pursued whenever similarities or complementarities with other regions are detected.”

With all this in mind, development of MRS3 seems very suitable for the task of propelling macro-regions such as Adriatic-Ionian macro-region higher up the GVCs and making it more competitive in

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globalized market, by avoiding already mentioned duplication of efforts and fragmentation. On the other hand, GVC analysis of macro-region proves itself inevitable in such an undertaking.

A brief overview of some common GVC indicators among countries of the Adriatic-Ionian region is given in the following section, in order to try to assess suitability of selected MRTPA for further development of the region. Due to time and budgetary constraints of the project, scope of GVC analysis of AIR macro-region is limited in its depth, but should provide, nonetheless, general overview of the state of GVCs in the macro-region.

Nevertheless, before participation in global value chains is laid out (also, per each of the MRTPA as they are devised in pilot MRS3 AIR), basic notions crucial for understanding trade flows within GVCs analysis should be further explained.

Forward participation denotes domestic value added sent to third economies, i.e. it reveals how much of value added of one country is present in exports of another country.

On the other hand, backward participation denotes foreign value added of (ones country) exports, i.e. how much of foreign value added is present in one’s country exports.

Furthermore, a ratio between Forward and Backward participation is called Net value added and serves as a measure of net gains in value added trade, i.e. whether an country/industry/sector is exporting more value added than it is importing.

Analysis of value chains in Adriatic-Ionian region is carried out on UNCTAD-EORA Global Value Chain database. UNCTAD-EORA database was selected, on basis that it contains information on value added for multiple sectors and that it includes all of the countries of AIR region.

By analysing global value chains within AIR region, some light will be shed on trade flows between countries constituting region, region itself and rest of the World, on basis of selected macro-regional thematic priority areas as are proposed in pilot macro-regional S3.
General presumptions regarding participation in Global value chains are as follows:87

1. Major resources exporters such as Russia, Saudi Arabia, Norway or Australia tend to be above imagined 45 degree line, as their exports are mainly resource based.
2. Manufacturing as an economic activity tends to have the highest shares of backward participation in GVCs (along with high levels of forward participation).
3. Lower left quadrant denotes low levels of participation in GVCs.
4. Upper right quadrant signifies high level participation in GVCs.
5. Most of the countries group narrowly along imagined 45 degree line, and are moving along imagined 45 degree line as their participation in GVCs increases.

Table 5 GVC participation in 2015

<table>
<thead>
<tr>
<th>Country</th>
<th>GVC participation (share of gross export)</th>
<th>Forward participation</th>
<th>Backward participation</th>
<th>GDP per capita (current US dollars)</th>
<th>Share of export to AIR region in total export</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>81%</td>
<td>38%</td>
<td>43%</td>
<td>32,746.61</td>
<td>3%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>77%</td>
<td>32%</td>
<td>45%</td>
<td>23,296.41</td>
<td>26%</td>
</tr>
<tr>
<td>Greece</td>
<td>33%</td>
<td>14%</td>
<td>19%</td>
<td>18,198.00</td>
<td>15%</td>
</tr>
<tr>
<td>Croatia</td>
<td>30%</td>
<td>16%</td>
<td>14%</td>
<td>13,176.53</td>
<td>41%</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>24%</td>
<td>16%</td>
<td>8%</td>
<td>5,180.78</td>
<td>45%</td>
</tr>
<tr>
<td>Albania</td>
<td>17%</td>
<td>9%</td>
<td>8%</td>
<td>4,450.01</td>
<td>70%</td>
</tr>
<tr>
<td>Montenegro</td>
<td>13%</td>
<td>3%</td>
<td>10%</td>
<td>7,702.57</td>
<td>43%</td>
</tr>
<tr>
<td>Serbia*</td>
<td>1%</td>
<td>0%</td>
<td>1%</td>
<td>5,912.08</td>
<td>35%</td>
</tr>
</tbody>
</table>


*data for Serbia is most likely corrupt

As it is visible from Table 5, among countries belonging to the Adriatic-Ionian region, Slovenia and Italy are the ones that participate in GVCs the most. Middle of the pack is populated by Croatia and Greece, with relatively mild at 33% and 30% respectively. Bottom of the list consists of the following countries: Bosnia and Herzegovina, Albania, Montenegro and Serbia. One has to point out that data on Serbia is probably corrupt, since Serbia, according to macro-economic data and level of development, should be somewhere between Greece and Bosnia and Herzegovina regarding participation in GVCs.

Heterogeneous nature of trade flows in AIR region regarding participation in GVCs, is offset by strong linkages that are revealed by traditional trade analysis. As it is also visible from the Table 5, share of the export to other countries of the AIR region of the countries belonging to AIR region is relatively high, except for Italy, where it comprises only 3% of total export.

Figure 22 illustrates the position of the countries of the AIR region regarding participation in GVCs (forward and backward linkages) and the per capita value of participation in GVCs. As it is visible in Table 5, as well, Italy and Slovenia, occupy, by far better position in GVCs, compared to rest of the AIR countries. On the other hand, the size of the circles, are showing the size of participation in GVC per capita, in order to control for the sheer size of economy. What is visible form the, Figure 22 is, that AIR region is combined of countries and regions that vary greatly considering the level of development.
Figure 22 Forward and backward GVC participation of AIR countries with absolute values of GVC participation per capita (size of the circle)


UNCTAD-EORA database is divided into 26 industry/sector categories, out of which particular sectors/industries were composed to resemble MRTPAs as are recommended in this pilot. Therefore, in order to analyse trade flows in value-added within AIR region, scope of MRTPAs was determined as it is proposed in Table 6. For example, MRTPA Agro-Bioeconomy consists of the following Industry/sectors within UNCTAD-EORA database: Agriculture, Fishing, Food & Beverage and Wood & Paper (all highlighted in green). Every subsequent MRTPA has its own color-code (see Table 6).
Table 6 Industry/Sectors of UNCTAD-Eora GVC database and their relation to MRTPA

|----------------|------------|-------------------|------------------|----------------|------------------------|-------------|--------------|---------------------|---------------------------|--------------------------|------------------------|------------------------------------------|------------------|----------------|------------------------------------------|------------------|----------------|---------------------|---------------------|------------------|---------------------|---------------------|------------------|---------------------|---------------------|------------------|---------------------|------------------|------------------|


Furthermore, Agro-Bioeconomy and every subsequent MRTPA were described and defined through the Eye@RIS3 tool. Using aforementioned tool, database containing relevant information about national and regional Smart specialisation strategies has been devised. Key set of facts, for determining scope of MRTPA were the NACE Rev. 2 codes associated with thematic priority areas of national and regional S3 documents that were subsumed under broader category MRTPA.
7.1 MRTPA Agro-Bioeconomy

As it is illustrated in Figure 23, frequency of NACE Rev. 2 codes (two-digit level), reveal the main economic activities within certain MRTPA. As it is visible from Figure 23, MRTPA Agro-Bioeconomy is defined by following NACE Rev. 2 codes:

1. **A.01 Crop and animal production, hunting and related service activities**
2. **C.10 Food products**
3. **C.11 Beverages**
4. **A.03 Fishing and aquaculture**
5. **J.63 Information service activities**
6. **J.62 Computer programming, consultancy and related activities**
7. **M.72 Scientific research and development**
8. **Q.86 Human health activities**
9. **A.02 Forestry and logging** and so.

NACE Rev. 2 codes that are in bold are then related to (linked to) Eora industry/sector classification. Complete accordance list for all MRTPAs is given in the Table 6.

*Figure 23 Agro-Bioeconomy defined by Eye@RIS3 tool*

Table 7 Percentage of Agro-Bioeconomy forward and backward GVC participation per country

<table>
<thead>
<tr>
<th>Agro-Bioeconomy</th>
<th>FORWARD PARTICIPATION</th>
<th>BACKWARD PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AIR (share of domestic inputs exported to third countries)</td>
<td>Rest of the world (share of domestic inputs that is exported to third countries)</td>
</tr>
<tr>
<td>Albania</td>
<td>8,2%</td>
<td>21,0%</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>5,1%</td>
<td>14,5%</td>
</tr>
<tr>
<td>Croatia</td>
<td>3,2%</td>
<td>9,8%</td>
</tr>
<tr>
<td>Greece</td>
<td>3,0%</td>
<td>19,9%</td>
</tr>
<tr>
<td>Italy</td>
<td>0,2%</td>
<td>7,6%</td>
</tr>
<tr>
<td>Montenegro</td>
<td>0,5%</td>
<td>15,7%</td>
</tr>
<tr>
<td>Serbia</td>
<td>0,4%</td>
<td>12,0%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1,4%</td>
<td>7,2%</td>
</tr>
</tbody>
</table>


Table 7 provides outlook on Forward and backward participation in GVC of the AIR region regarding Agro-Bioeconomy sector. As it is visible from the Table 7, Albania and Bosnia and Herzegovina are the sole members from the AIR region that, to a certain extent, participate in GVCs through AIR region. Given that Albania and Bosnia and Herzegovina belong to countries that moderately participate in GVC (24 % and 17 % respectively), indicates that their export is probably mostly of regional character.

On the other hand, economies of Slovenia and Italy that highly participate in GVCs, are absent from potential regional value chain, which does not serve them, nor as resource base regarding backward linkages in GVC, nor as export vehicle, regarding forward linkages. Whereas low participation in forward linkages is not a surprise given the heterogeneous levels of development of economies in AIR region, low participation in backward linkages, confirms untapped investment and trade potential in the macro-region.

**FORWARD LINKAGES**

As it is already defined, forward linkages of trade flow in value added constitute of domestic value added of one’s country that is sent to third economies. Sankey diagram in Figure 24 illustrates domestic value added of eight countries belonging to AIR region and their forward linkages. It is visible that, trade flows in value-added in sectors that fall within scope of MRTPA Agro-Bioeconomy, are largely directly exporting domestic value added, or are targeted at other countries, ones not belonging to AIR region.
OIS-AIR Pilot of Adriatic-Ionian MRS3

Figure 24 Agro-Bioeconomy Sankey diagram of forward linkages in AIR region share in total domestic value-added


Findings cast light on weak collaboration among economies in the region, and almost non-existent forward component of regional value chain, except for the economies of Albania and Bosnia and Herzegovina. This fact, although withering, needs not be restrictive in the sense of future developments. Almost all of the countries of AIR region have relatively large Agro-Bioeconomy sectors (see Figure 26), and, what is even more important, have targeted it as a thematic priority area within their national/regional strategic documents (notably S3s). Therefore, focus on Agro-Bioeconomy, as a thematic priority area of macro regional Smart Specialisation Strategy could prove as a valuable resource in upgrading position in GVCs, regarding Agro-Bioeconomy sector, of each country in AIR region, as well as in creation of regional value chain in that domain. As we will see in the next chapter, R&D competences in this field have been well developed through participation in competitive FP7 and H2020 projects. Therefore, existing networks of excellence should/could serve as an elevator for regional economies.
BACKWARD LINKAGES

Figure 25 Agro-Bioeconomy Sankey diagram of backward linkages in AIR region (share in total domestic value-added)


Backward GVC linkages are defined as foreign value added content of exports, and are referred to as vertical specialisation. This indicator corresponds to the value added of inputs that were imported in order to produce intermediate or final goods/services to be exported.

As it is visible from Figure 25, Albania, Croatia and Bosnia and Herzegovina and to a certain extent, Greece and Slovenia, have their “resource base” in AIR region, whereas, largest and most developed economy of the region, Italy, imports large proportion of its inputs in Agro-Bioeconomy sector from other countries of the world. These findings, as well as the previous, highlight the fact, that there is a weak “vertical specialisation” within the region, considering Agro-Bioeconomy sector. As it was mentioned before, weak position could be improved through upgrading of position each country/region occupies in global/regional value chain through RDI collaboration between existing R&D networks and companies from the AIR region.
Importance of Agro-Bioeconomy as a field of specialisation in AIR region is brought to light in Figure 26. As it is visible, almost all countries of the region have substantial size of participation in GVCs. Moreover, Agro-Bioeconomy already, as it was mentioned above, shows light indication of developing regional value chain that should largely benefit from pilot MRS3 in terms of further development.

7.2 MRTPA Energy and Environment

Figure 27 shows frequency of NACE Rev. 2 codes in MRTPA Energy and Environment within national and regional documents of AIR region. As it is already explained, NACE Rev. 2 codes define the scope of economic activities within MRTPA and are then linked to UNACTAD-EORA database sectors. NACE Rev. 2 codes are the following:

1. **D.35 Electricity, gas, steam and air conditioning supply**
2. **E.38 Waste collection, treatment and disposal activities; materials recovery**
3. **M.72 Scientific research and development**
4. **E.39 Remediation activities and other waste management services**
5. **C.26 Computer, electronic and optical products**
6. **C.27 Electrical equipment**
7. **(...)**
8. **F.41 Construction of buildings**
9. **F.43 Specialized construction activities**

*Figure 27 Energy and Environment defined by Eye@RIS3 tool*

Table 8 Percentage of Energy and Environment forward and backward GVC participation per country

<table>
<thead>
<tr>
<th>Energy and Environment</th>
<th>FORWARD PARTICIPATION</th>
<th>BACKWARD PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AIR (share of domestic inputs exported to third countries)</td>
<td>Rest of the world (share of domestic inputs that is exported to third countries)</td>
</tr>
<tr>
<td>Albania</td>
<td>1.3%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>1.7%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Croatia</td>
<td>1.2%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Greece</td>
<td>0.6%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Italy</td>
<td>0.1%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Montenegro</td>
<td>0.3%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Serbia</td>
<td>0.2%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0.7%</td>
<td>4.7%</td>
</tr>
</tbody>
</table>


Whereas total participation in GVCs in Agro-Bioeconomy sector were relatively high, in the Energy and Environment sector participation is relatively low. This is partly due to nature of the data and making of the sectors according to NACE Rev. 2 codes. Nonetheless, most prolific participation in GVCs in this sector is recorded by Montenegro and Serbia. Shares of forward and backward trade in value added in AIR region are quite lower than they are in global perspective, pointing toward low integration of Energy and Environment sector in AIR region.

FORWARD LINKAGES

Figure 28 Energy and Environment Sankey diagram of forward linkages in AIR region (share in total domestic value-added)

Forward participation in the sector of Energy and Environment, regarding AIR region, as it is quite clearly presented in Figure 28, shows that Albania, Bosnia and Herzegovina and Croatia are countries the most dominant in the AIR regional value chain regarding their trade flows in value added. Others are weakly participating in AIR region trade flows, relative to Energy and Environment sector.

BACKWARD LINKAGES

*Figure 29 Energy and Environment Sankey diagram of backward linkages in AIR region (share in total domestic value-added)*


Backward linkages across AIR region are, weak, and AIR region represents substantial “resource base” for Albania and Bosnia and Herzegovina, and to a certain extent Montenegro. As it is visible from Figure 30, Energy and Environment sector across AIR region is weakly integrated in GVCs, regarding backward linkages. Weak integration of Energy and Environment sector is well visible from Figure 30, where only Serbia and Montenegro stand out, whereas all others countries are weakly integrated into GVC or regional trade in value added.
Figure 30 Forward and backward GVC participation of AIR countries along with share of GVC participation of Energy and Environment sector in total GVC participation (size of bubble)

7.3 MRTPA Transport and Mobility

Figure 31 illustrates frequency of NACE Rev. 2 codes in MRTPA Transport and Mobility within national and regional documents of AIR region. As it is already explained, NACE Rev. 2 codes define the scope of economic activities within MRTPA and are then linked to UNACTAD-EORA database sectors. NACE Rev. 2 codes are the following:

1. H.49 Land transport and transport via pipelines
2. C.30 Other transport equipment
3. C.29 Motor vehicles, trailers and semi
4. H.50 Water transport
5. H.52 Warehousing and support activities for transportation
6. J.63 Information service activities

Figure 31 Transport and Mobility defined by Eye@RIS3 tool

The analysis of participation in GVCs in the sector of Agro-Bioeconomy, hinted at existence of regional value chain, in Transport and Mobility sector that cannot be assumed. Although almost all countries participate substantially in GVCs through the sector of Transport and Mobility, regional chain is almost non-existent. This can be seen from the following figures: most developed economies of AIR region, Italy and Slovenia, participate in regional value chain with less than 1% (Italy) and around 5% (Slovenia), as well as Greece, whose participation in regional value chain is below 2% (although its transport sector is one of the most developed globally, especially maritime transport), while in global value chains participates with more than 13%. These figures point towards relatively weak collaboration in AIR region, but need not be limiting regarding development of the Transport and Mobility sector. As it was already mentioned in the case of Agro-Bioeconomy sector, weak figures can be seen as a window of opportunity pointing towards future developments of the sector through mutual collaboration on topics provided by this document.

**FORWARD LINKAGES**

Forward linkages in Transport and Mobility sector are illustrated on Figure 32, where it is visible that AIR region is not “export vehicle” for other economies in the region, pointing toward weak collaboration in the sector of Transport and Mobility. Leading countries concerning this sector of Transport and Mobility (see Figure 34) are Italy and Slovenia, that are weakly engaged in forward trade flows with AIR region relative to their total participation in GVCs. Largest forward participation in AIR region, relative to its total participation in GVCs, is noted in Albania, Croatia and Bosnia and Herzegovina.
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Figure 32 Transport and Mobility Sankey diagram of forward linkages in AIR region (share in total domestic value-added)


BACKWARD LINKAGES

Figure 33 illustrates backward linkages between the rest of the world and AIR region and member countries of AIR region. It is visible, that Slovenia, as a one of the leaders of the sector along with Italy, to a certain extent has a “resource base” in AIR region, whereas Italy does not rely as much on AIR region for inputs, or they are of low value added. It is notable that, Albania, Bosnia and Herzegovina and Croatia along with Slovenia, have found, to a certain extent, their “vertical specialisation” within AIR region.

Figure 33 Transport and Mobility Sankey diagram of backward linkages in AIR region (share in total domestic value-added)

Figure 34 provides fine illustration of Transport and Mobility sector in AIR region. Slovenia and Italy stand out as leaders, and their participation in GVCs, both forward and backward is high in this sector, but except Slovenia securing certain amount of resources in AIR region, little of their trade flow in value added is connected to AIR region. Rest of the countries of the AIR region, regarding sector of Transport and Mobility are in a similar position, relative to their participation in GVCs.

Figure 34 Forward and backward GVC participation of AIR countries along with share of GVC participation of Transport and Mobility sector in total GVC participation (size of bubble)

Transport and Mobility

7.4 MRTPA Tourism and Culture

Figure 35 illustrates frequency of NACE Rev. 2 codes in MRTPA Tourism and Culture within national and regional documents of AIR region. As it is already explained, NACE Rev. 2 codes define the scope of economic activities within MRTPA and are then linked to UNACTAD-EORA database sectors. NACE Rev. 2 codes are the following:

1. **I.55 Accommodation**
2. **I.56 Food and Beverage service activities**
3. **R.90 Creative arts and entertainment activities**
4. **N.79 Travel agency, tour operator and other reservation services and related activities**
5. **R.91 Libraries, Archives, Museums and other cultural activities**
6. **R.93 Sports activities and amusement and recreation activities**
7. **J.63 Information service activities**

*Figure 35 Tourism and Culture defined by Eye@RIS3 tool*

Table 10 Percentage of Tourism and Culture forward and backward GVC participation per country

<table>
<thead>
<tr>
<th>Tourism and Culture</th>
<th>FORWARD PARTICIPATION</th>
<th>BACKWARD PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AIR (share of domestic inputs exported to third countries)</td>
<td>Rest of the world (share of domestic inputs exported to third countries)</td>
</tr>
<tr>
<td>Albania</td>
<td>0.7%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>0.4%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Croatia</td>
<td>0.3%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Greece</td>
<td>0.2%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Italy</td>
<td>0.0%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Montenegro</td>
<td>0.1%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Serbia</td>
<td>0.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0.1%</td>
<td>1.1%</td>
</tr>
</tbody>
</table>


Concerning the sector of Tourism and Culture, integration into GVCs is relatively low, although it could be due to a problem of the database and defined scope of the sector. Nonetheless, largest forward integration into GVCs is shown by Montenegro, and largest forward linkages in AIR region are present in Albania. It is interesting that, Greece and Croatia, whose tourist sectors are of relatively large, representing around 20% of their respective GDPs, are relatively weakly integrated into value chains. Weak integration of trade flows in value added of AIR region regarding Tourism and Culture, on the one hand, can be observed as an opportunity to be seized through mutual collaboration.

**FORWARD LINKAGES**

*Figure 36 Tourism and Culture Sankey diagram of forward linkages in AIR region (share in total domestic value-added)*

On the other hand backward linkages in Tourism and Culture sector are more prominent in Albania, Bosnia and Herzegovina and Croatia, regarding AIR region.

BACKWARD LINKAGES

Figure 37 Tourism and Culture Sankey diagram of backward linkages in AIR region (share in total domestic value-added)


Figure 38 illustrates position in GVC and relative size of Tourism and Culture sector in AIR region. As it was the case with the sector of Energy and Environment, it is visible that relative size of participation of Tourism and Culture sector in total GVC participation is similar among the countries of the AIR region. Only standout country, by its relative value of Tourism and Culture sector in total GVC participation is Montenegro.
Figure 38 Forward and backward GVC participation of AIR countries along with share of GVC participation of Tourism and Culture sector in total GVC participation (size of bubble)

7.5 MRTPA Health and Medicine

Figure 39 illustrates frequency of NACE Rev. 2 codes in MRTPA Health and Medicine within national and regional documents of AIR region. As it is already explained, NACE Rev. 2 codes define the scope of economic activities within MRTPA and are then linked to UNACTAD-EORA database sectors. NACE Rev. 2 codes are the following:

1. **Q.86 Human health activities**
2. **C.21 Basic pharmaceutical products and pharmaceutical preparations**
3. **Q.87 Residential care activities**
4. **C.26 Computer, electronic and optical products**
5. **M.72 Scientific research and development**
6. **C.10 Food products**

![Figure 39 Health and Medicine defined by Eye@RIS3 tool](source)


Sector of Health and Medicine is no different from sector of Tourism and Culture, regarding the participation in GVCs. Largest forward linkages are noted in Slovenia (6.7%), with the stress to the fact that Slovenia has tenfold participation in GVC compared to AIR value chain.
Table 11 Percentage of Health and Medicine forward and backward GVC participation per country

<table>
<thead>
<tr>
<th>Health and Medicine</th>
<th>FORWARD PARTICIPATION</th>
<th>BACKWARD PARTICIPATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AIR</td>
<td>Rest of the world</td>
</tr>
<tr>
<td></td>
<td>(share of domestic inputs exported to third countries)</td>
<td>(share of domestic inputs exported to third countries)</td>
</tr>
<tr>
<td>Albania</td>
<td>0.6%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>0.4%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Croatia</td>
<td>0.5%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Greece</td>
<td>0.2%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Italy</td>
<td>0.1%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Montenegro</td>
<td>0.2%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Serbia</td>
<td>0.1%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0.7%</td>
<td>6.0%</td>
</tr>
</tbody>
</table>


FORWARD LINKAGES

Figure 40 Health and Medicine Sankey diagram of forward linkages in AIR region (share in total domestic value-added)

Concerning backward linkages, Italy is leading the pack, with highest level of backward GVC participation, and Albania has the highest level of backward participation in AIR value chain.
**BACKWARD LINKAGES**

*Figure 41 Health and Medicine Sankey diagram of backward linkages in AIR region (share in total domestic value-added)*


*Figure 42 illustrates relative size and position of the sector of Health and Medicine in respect to GVC participation. It is visible that Slovenia, Italy and Montenegro stand out among countries in AIR region, whereas others are more or less the same size and position.*

*Figure 42 Forward and Backward GVC participation of AIR countries along with share of GVC participation of Health and Medicine sector in total GVC participation (size of bubble)*


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Concluding remarks

Regarding insights derived from analysing participation in Global Value chains in Adriatic-Ionian macro-region, the main findings can be described in following manner:

8. Regarding participation in Global Value chains, **Italy and Slovenia are leaders in AIR region**, with all other countries lagging behind substantially.

8. Although, trade relations, measured in traditional trade flows, show that AIR region is to a great extent interdependent (primarily among less developed economies of the macro-region, which is for most of the primary export market), in terms of trade in value added, as measured in Global Value chain analysis, points toward almost completely opposite conclusions. Therefore, one might conclude that **collaboration** (seen as trade flows of goods and services) is quite strong, but it is taking place outside of the Global value chains.

8. **Italy and Slovenia**, as a leaders in GVC participation, are not connected to the region in terms of Forward or Backward participation, meaning, they do not have their “resource base” in AIR region, nor the AIR region is used as “export vehicle” for both respective economies.

8. Out of all MRTPs analysed, **only MRTPA Agro-Bioeconomy**, at the level of the macro-region to a certain extent, participates in Global Value chain, whereas all the other TPAs, are not as prolific.

8. **Weak interdependence in AIR region**, in terms of trade in value added, should be seen as an opportunity rather than a limiting factor, considering future collaboration within a scope of MRS3. As we already established, relatively strong sectoral base in all of AIR region member countries, which will be supplemented with R&D excellence found in the region, on specific topics, should help member countries improve their competitive edge in global markets.
8. Macro-regional R&D excellence network

Framework Programme 7 (FP7) and Horizon 2020 are considered as exceptionally competitive and therefore supportive of excellence in R&D. Only slightly over 18 %⁸⁹ of all applications to FP7 got funded, and so far in H2020, success rate is just over 11 %,⁹⁰ whereas in some fields is as low as 2,5 %.⁹¹

With those facts in mind, intention is to use data on FP7 and H2020 projects, to assess R&D excellence in AIR region in selected thematic priority areas, in order to corroborate selection process and map out AIR region excellence networks. Along mapping R&D networks in AIR region, one of the goals is to identify key actors in R&D networks of AIR region through usage of some of the concepts from Social Network Analysis.

Social network analysis (SNA) “focuses on the structure of ties within a set of social actors, e.g. persons, groups, organizations, and nations, or the products of human activity or cognition such as web sites, semantic concepts, and so on. It is linked to structuralism in sociology stressing the significance of relations among social actors to their behaviour, opinions, and attitudes. SNA is felt to be appropriate for analysing social cohesion, brokerage and exchange, as well as social ranking within or among social groups.”⁹²

Furthermore, “the development and interest in SNA has increased sharply over the last few decades due to the application of mathematics – notably graph theory and statistical models – and the wide availability of software for network analysis both commercial and freely available through the internet. In addition to the formal, quantitative approach to social network analysis, a qualitative approach to social networks is developing.”⁹³

Another impetus to map out R&D networks in AIR region comes from conclusions and recommendations published in the “Study on Network Analysis of the 7th Framework Programme Participation” published by the DG for Research and Innovation.⁹⁴

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⁹³ Ibid.
In aforementioned study, which undertook massive task of mapping all projects funded under FP7, following recommendations based on analysis were provided:

1. European Commission should allow existing networks to receive additional funding in successive calls provided they demonstrate excellence and secure approval in peer reviews.
2. In the case that an established network is supported in successive calls, the Commission should ascertain that new members are present.
3. That interdisciplinarity and intersectorality should not become mandatory elements in framework programme calls.
4. The Commission should require that coordinators have demonstrated project management skills and networks have a clearly stated project management approach.

In light of these findings and recommendations, importance of mapping existing networks of R&D excellence in AIR region becomes almost compulsory, as they are seen to benefit AIR region not only through providing excellence in R&D, but also as facilitators of knowledge and technology transfer from developed to those less developed.

Therefore, analysis sets out two goals:

1. firstly, to identify and determine size of R&D networks of AIR region per thematic priority area as selected by this document, and
2. secondly, to describe RDI landscape of AIR region using network “lenses” for identifying key actors within existing networks of R&D excellence.

Data on FP7 and H2020 projects for this exercise was obtained from CORDIS\textsuperscript{95} database. Data was structured according to two criteria:

1. R&D institutions located in AIR region
2. project theme that falls under one of the selected TPA of MRS3.

After data has been structured, using online data visualization platform for social network analysis, Kumu.io\textsuperscript{96}, networks graphs were drawn between different R&D institutions in AIR region based on their collaboration on FP7 or H2020 projects.

Furthermore, ability of online platform to calculate SNA metrics Betweenness indicator is used. Indicator in question “measures how many times an element lies on the shortest path between two other elements.”\textsuperscript{97} In general, elements that score high on Betweenness indicator are ones that have more control over the flow of information and are able to act as key links within the network. They can also be potential single points of failure. Formal expression of Betweenness indicator of centrality in SNA is given in following equation:

\[ C_B(i) = \sum_{j \neq k} \frac{g_{jk}(i)}{g_{jk}} \]

Where \( g_{jk}(i) \) equals to the number of shortest paths connecting \( jk \) passing through \( i \)

\textsuperscript{95} CORDIS, https://cordis.europa.eu/, retrieved: 29.1.2019
\textsuperscript{96} Kumu, https://kumu.io/, retrieved: 29.1.2019
\textsuperscript{97} Università degli Studi G.D’Annunzio Chieti Pescara, https://www.sci.unich.it/~francesc/teaching/network/betweenness.html, retrieved: 29.1.2019
\( g_{jk} \) equals to total number of shortest paths.

And \( j, k \), and \( i \) are nodes (in this case R&D institutions) in network.

Before laying out results of the analysis, one should, in short explain, fundamental elements of social networks.

Social networks consist of nodes and links. Nodes in network analysis represent people, organizations, etc. (in this case nodes are R&D organizations from AIR region) and link represent relationship between nodes. Links in this case represent relationships between R&D organizations that have emanated from collaboration on FP7 or H2020 projects.

Networks are built in following matter:

1. Coordinator of the project is the only node connected to all other collaborators on the project. By structuring network in this way, a lot of “weight” is put on project coordinators making them a focal point of the network. This is done, in order to ascribe higher level of importance in analysis on lead partner, as usually, the lead partner is the initiator of the project and usually the one that gave birth to idea that lead to the project proposal.
2. Collaborators on the project are not linked to each other. Furthermore, networks are created as non-directional in flow.

R&D networks per MRTPA of Macro-Regional Smart Specialisation Strategy (MRS3):

1. **MRTPA Agro-Bioeconomy**
   - FP7 topic: Knowledge based bioeconomy
   - H2020 topic: Food security, sustainable agriculture and forestry

2. **MRTPA Energy and Environment**
   - FP7 topic: Energy
   - FP7 topic: Environment
   - H2020 topic: Climate action, environment, resource efficiency and raw materials
   - H2020 topic: Secure, clean and efficient energy

3. **MRTPA Transport and Mobility**
   - FP7 topic: Transport
   - H2020 topic: Smart, green and integrated transport

4. **Tourism and Culture**
   - FP7 topic: ICT
   - H2020 topic: ICT

5. **Health and Medicine**
   - FP7 topic: Health
   - H2020 topic: Health, demographic change and wellbeing
8.1 MRTPA Agro-Bioeconomy

FP7 topic Knowledge based bioeconomy

Figure 43 Network of R&D institutions in AIR region collaborating in themes that fall under Agro-Bioeconomy MRTPA of MRS3 (FP7)

As it is visible from the Figure 43, network of R&D organizations whose projects were funded under FP7 and fall under MRTPA Agro-Bioeconomy.

In the network, there are 115 organizations from AIR region present, and they have collaborated on 174 projects. As it is visible from Table 12, key actors in AIR region, according to Betweenness indicator are:

1. ALMA MATER STUDIORUM – UNIVERSITÀ DI BOLOGNA
2. UNIVERSITÀ DEGLI STUDI DI MILANO
3. UNIVERZA V LJUBLJANI
4. HELLENIC CENTRE FOR MARINE RESEARCH
5. UNIVERSITY DEGLI STUDI DI PADOVA

Considering that Betweenness indicator reveals the information about key facilitators in network, these organizations should be considered as facilitators of future development, and ones that can...
serve as bridges for knowledge and technology transfer from more developed to less developed regions of the AIR macro-region.

Furthermore, as it is visible from Figure 43, quite large share of institutions and projects is not connected to the majority of the network, therefore, regarding recommendations from the above mentioned report, policymakers should incentivize enlargement of the R&D network in order to improve on knowledge and technology transfer across region.

Table 12 Rank according to Betweenness centrality indicator and value of indicator for Agro-Bioeconomy MRTPA (FP7)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Label</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA</td>
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<td>#2</td>
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<tr>
<td>#3</td>
<td>UNIVERSITA DEGLI STUDI DI MILANO</td>
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<tr>
<td>#4</td>
<td>STICHTING WAGENINGEN RESEARCH</td>
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<tr>
<td>#5</td>
<td>UNIVERZA V LJUBLJANI</td>
<td>0.055</td>
</tr>
<tr>
<td>#6</td>
<td>HELLENIC CENTRE FOR MARINE RESEARCH</td>
<td>0.051</td>
</tr>
<tr>
<td>#7</td>
<td>UNIVERSITA DEGLI STUDI DI PADOVA</td>
<td>0.048</td>
</tr>
<tr>
<td>#8</td>
<td>THE SECRETARY OF STATE FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS</td>
<td>0.035</td>
</tr>
<tr>
<td>#9</td>
<td>UNIVERSITA CATTOLICA DEL SACRO CUORE</td>
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<tr>
<td>#10</td>
<td>NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA</td>
<td>0.030</td>
</tr>
<tr>
<td>#11</td>
<td>AGRICULTURAL UNIVERSITY OF ATHENS</td>
<td>0.027</td>
</tr>
<tr>
<td>#12</td>
<td>CENTRE DE COOPERATION INTERNATIONALE EN RECHERCHE AGRONOMIQUE POUR LEDEVELOPPEMENT - C.I.R.A.D. EPIC</td>
<td>0.025</td>
</tr>
<tr>
<td>#13</td>
<td>CONSIGLIO NAZIONALE DELLE RICERCHE</td>
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</tr>
<tr>
<td>#14</td>
<td>UNIVERSITEIT GENT</td>
<td>0.022</td>
</tr>
<tr>
<td>#15</td>
<td>ARISTOTELIO PANEPISTIMIO THESSALONIKIS</td>
<td>0.021</td>
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<td>#16</td>
<td>HAROKOPIO UNIVERSITY</td>
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<td>#19</td>
<td>LUDWIG-MAXIMILIANS-UNIVERSITAET MUEENCHEN</td>
<td>0.017</td>
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<td>#20</td>
<td>ISTITUTO ZOOprofilattico Sperimentale dell’Abruzzo e del Molise G Caporale</td>
<td>0.017</td>
</tr>
</tbody>
</table>

H2020 topic Food security, sustainable agriculture and forestry

Figure 44 Network of R&D institutions in AIR region collaborating in themes that fall under Agro-Bioeconomy MRTPA of MRS3 (H2020)

Figure 44 shows R&D network emanated from collaboration on H2020 projects in under the topic Food security, sustainable agriculture and forestry, which is, in a real sense, successor to the topic of Knowledge based bioeconomy from the FP7.

Network consists of 118 R&D organizations from AIR region that have collaborated on 182 projects. As it is visible from Table 13, key actors in Agro-Bioeconomy R&D network in AIR region were R&D organizations that played a key role in R&D network in previous programme (FP7):

1. ALMA MATER STUDIORUM – UNIVERSTIA DI BOLOGNA
2. UNIVERZA V LJUBLJANI
3. CONSIGLIO NAZIONALE DELLE RICERCHE
4. AGRICULTURAL UNIVERSITY OF ATHENS
5. ETHNIKO KAI KAPODISRIAKO PANEPISTIMO ATHINON

Table 12 and Table 13, when compared, reveal that two R&D institutions from AIR region are key actors in Agro-Bioeconomy R&D network in both programs (FP7 and H2020). In light of the recommendations from afore mentioned studies, this fact illustrates consistency in R&D excellence within this R&D network.

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Table 13 Rank according to Betweenness centrality indicator and value of indicator for Agro-Bioeconomy MRTPA (H2020)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Label</th>
<th>Value</th>
</tr>
</thead>
<tbody>
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<td>#2</td>
<td>UNIVERZA V LJUBLJANI</td>
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<tr>
<td>#3</td>
<td>CONSIGLIO NAZIONALE DELLE RICERCHE</td>
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<td>#4</td>
<td>STICHTING WAGENINGEN RESEARCH</td>
<td>0.055</td>
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<tr>
<td>#5</td>
<td>AGRICULTURAL UNIVERSITY OF ATHENS</td>
<td>0.054</td>
</tr>
<tr>
<td>#6</td>
<td>ETI-NIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON</td>
<td>0.048</td>
</tr>
<tr>
<td>#7</td>
<td>UNIVERSITA DEGLI STUDI DI PADOVA</td>
<td>0.044</td>
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<td>#8</td>
<td>UNIVERSITA DEGLI STUDI DI PERUGIA</td>
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<tr>
<td>#9</td>
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<td>PANEPISTIMIO THESSALIAS</td>
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<tr>
<td>#11</td>
<td>UNIVERSITY COLLEGE DUBLIN, NATIONAL UNIVERSITY OF IRELAND, DUBLIN</td>
<td>0.029</td>
</tr>
<tr>
<td>#12</td>
<td>HELLENIC CENTRE FOR MARINE RESEARCH</td>
<td>0.028</td>
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8.2 MRTPA Energy and Environment

FP7 topic Energy and FP7 topic Environment

Figure 45 Network of R&D institutions in AIR region collaborating in themes that fall under Energy and Environment MRTPA of MRS3 (FP7)


Figure 45 illustrates the R&D network that has originated through collaboration of R&D organization from AIR region on FP7 projects under themes of Energy and Environment.

R&D network is quite large but as it is visible from the Figure 45, quite poorly interlinked. R&D network consists of 173 R&D organizations from AIR region that have collaborated on 284 R&D project under themes Energy and Environment.

Key actors or facilitators that are disclosed by calculating indicator Betweenness are as follows:

1. ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
2. NATIONAL TECHNICAL UNIVERSITY OF ATHENS – NTUA
3. POLITECNICO DI MILANO
4. PANEPISTIMO PATRON
5. ALMA MATER STUDIORUM – UNIVERSITA DI BOLOGNA

OIS-AIR is implemented through the financial support of the ADRION programme
Table 14 Rank according to Betweenness centrality indicator and value of indicator for Energy and Environment MRTPA (FP7)

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<td>CENTRO RICERCHE FIAT SCPA</td>
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<td>AIRBUS OPERATIONS GMBH</td>
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<td>UNIVERSITY OF NEWCASTLE UPON TYNE</td>
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</table>

H2020 topic Climate action, environment, resource efficiency and raw materials and H2020 topic Secure, clean and efficient energy

**Figure 46 Network of R&D institutions in AIR region collaborating in themes that fall under Energy and Environment MRTPA of MRS3 (H2020)**

R&D network that grew through collaboration on H2020 R&D projects in AIR region consists out of 98 R&D organizations that cooperated on 180 R&D projects in fields of Energy and Environment, as it is visible on Figure 46.

Again, as it was case with R&D network in Transport & Mobility area, the network under H2020 programme is considerably smaller in size compared to R&D network that grew out of participation in FP7 programme under same topic.

Key actors in R&D network created under H2020 programme are:

1. CONSIGLIO NAZIONALE DELLE RICERCHE
2. FONDAZIONE CENTRO EURO-MEDITERRANEO SUI CAMBIAMENTI CLIMATICI
3. ARISTOTELIO PANEPISTIMO THESSALONIKIS
4. NATIONAL TECHNICAL UNIVERSITY OF ATHENS – NTUA
5. INSTITUT JOZEF STEFAN
Solely one R&D organization managed to be among Top 5 key actors in R&D networks stemming out both FP7 and H2020, and that is National Technical university of Athens. However, since, H2020 is still ongoing programme, some of the key actors from R&D networks that stemmed out of participation in FP7 projects, could take place among top 5 key actors in R&D network that is growing out of participation and collaboration in H2020 projects.

Table 15 Rank according to Betweenness centrality indicator and value of indicator for Energy and Environment MRTPA (H2020)

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<td>INSTITUT JOZEF STEFAN</td>
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<tr>
<td>#6</td>
<td>INTERNATIONALES INSTITUT FUR ANGEWANDE SYSTEMANALYSE</td>
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<td>#7</td>
<td>CENTRE FOR RENEWABLE ENERGY SOURCES AND SAVING FONDATION</td>
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<td>#8</td>
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<td>ETRA INVESTIGACION Y DESARROLLO SA</td>
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<td>#14</td>
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<tr>
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<td>#16</td>
<td>UNIVERZA V LJUBLJANI</td>
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<tr>
<td>#17</td>
<td>POLITECNICO DI MILANO</td>
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<tr>
<td>#18</td>
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<td>UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA</td>
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<tr>
<td>#20</td>
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</table>

8.3 MRTPA Transport and Mobility

**FP7 topic Transport**

*Figure 47 Network of R&D institutions in AIR region collaborating in themes that fall under Transport and Mobility MRTPA of MRS3 (FP7)*

Transport and Mobility R&D network that emanated through participation in FP7 projects consist of 66 R&D organizations from AIR region that have collaborated on 284 projects.

Key actors in Transport and Mobility R&D network are as follows:

1. ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
2. NATIONAL TECHNICAL UNIVERSITY OF ATHENS – NTUA
3. POLITECNICO DI MILANO
4. PANEPISTIMO PATRON
5. ALMA MATER STUDIORUM – UNIVERSITA DI BOLOGNA

Even more than in case of Agro-Bioeconomy, considering enlargement of the Transport and Mobility R&D networks could prove fruitful, in order to improve on knowledge and technology transfer within AIR region. Joining R&D organizations that are not interlinked with larger R&D network should be one of the key priorities in development of the region.
Table 16 Rank according to Betweenness centrality indicator and value of indicator for Transport and Mobility MRTPA (FP7)

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<td>PANEPISTIMIO PATRON</td>
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<td>#6</td>
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<td>#7</td>
<td>DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV</td>
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</table>

H2020 topic Smart, green and integrated transport

Figure 48 Network of R&D institutions in AIR region collaborating in themes that fall under Transport and Mobility MRTPA of MRS3 (H2020)

Transport and Mobility network that was setup through collaboration in H2020 projects consist of 40 R&D organizations that have collaborated on 108 projects. The R&D network under H2020 programme is notably smaller in size in comparison to R&D network that has emanated through collaboration under FP7. This fact might be due to, that H2020 programme is still ongoing, so we might expect that, network might enlarge as H2020 nears its end.

Key actors in Transport and Mobility R&D network are following:

1. INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
2. ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
3. ARISTOTELIO PANEPISTIMO THESSALONIKIS
4. CENTRO RICERCHE FIAT SCPA
5. POLITECNICO DI MILANO

As in the case of Agro-Bioeconomy R&D networks, two key actors remained at their position as one of key facilitators within Transport and Mobility R&D network within AIR region.
Table 17 Rank according to Betweenness centrality indicator and value of indicator for Transport and Mobility MRTPA (H2020)

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8.4 MRTPA Tourism and Culture

FP7 topic ICT

Figure 49 Network of R&D institutions in AIR region collaborating in themes that fall under Tourism and Culture MRTPA of MRS3 (FP7)


MRTPA Tourism and Culture does not relate directly to a topic within FP7 programme, but ICT is seen as a key enabling technology that drives innovation in sector of tourism and culture.

Therefore, on Figure 49, we graphed AIR region R&D network that grew out of collaboration on FP7 programme under theme of ICT. The R&D network consists of 234 R&D organizations that have collaborated on 369 projects.

The ICT R&D network is by far the largest R&D network in AIR region. The key actors of ICT R&D network of AIR region are as follows:

1. INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
2. ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
3. POLITECNICO DI MILANO
4. INSTITUT JOZEF STEFAN
5. FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS
Table 18 Rank according to Betweenness centrality indicator and value of indicator for Tourism and Culture MRTPA (FP7)

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</table>

H2020 topic ICT

Figure 50 Network of R&D institutions in AIR region collaborating in themes that fall under Tourism and Culture MRTPA of MRS3 (H2020)


Figure 50 shows ICT R&D network of AIR region that originated from collaboration on H2020 projects under ICT topic. ICT R&D network consists of 96 R&D organizations from AIR region that have collaborated on 165 projects.

Key actors of the R&D network, according to centrality measure, Betweenness are as follows:

1. POLITECNICO DI MILANO
2. ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
3. INSTITUT JOZEF STEFAN
4. INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
5. ENGINEERING – INGEGNERIA INFORMATICA SPA

As it is visible, ICT R&D networks are little changes from FP7 to H2020 programme. Same 4 key actors occupy position of key facilitators within network.
Table 19 Rank according to Betweenness centrality indicator and value of indicator for Tourism and Culture MRTPA (H2020)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Label</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>POLITECNICO DI MILANO</td>
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<tr>
<td>#2</td>
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<tr>
<td>#3</td>
<td>INSTITUT JOZEF STEFAN</td>
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</tr>
<tr>
<td>#4</td>
<td>INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS</td>
<td>0.093</td>
</tr>
<tr>
<td>#5</td>
<td>ENGINEERING - INGEGNERIA INFORMATICA SPA</td>
<td>0.075</td>
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<tr>
<td>#6</td>
<td>ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHONON</td>
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<tr>
<td>#7</td>
<td>FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.</td>
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<td>#8</td>
<td>UNIVERZA V LJUBLJANI</td>
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</tr>
<tr>
<td>#9</td>
<td>Teknologian tutkimuskeskus VTT Oy</td>
<td>0.052</td>
</tr>
<tr>
<td>#10</td>
<td>FOUNDATION FOR RESEARCH AND TECHNOLOGY HELAS</td>
<td>0.048</td>
</tr>
<tr>
<td>#11</td>
<td>ATOS SPAIN SA</td>
<td>0.044</td>
</tr>
<tr>
<td>#12</td>
<td>ARISTOTELIO PANEPISTIMIO THESSALONIKIS</td>
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</tr>
<tr>
<td>#13</td>
<td>INTRASOFT INTERNATIONAL SA</td>
<td>0.041</td>
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<tr>
<td>#14</td>
<td>PANEPISTIMIO PATRON</td>
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<tr>
<td>#15</td>
<td>CONSORZIO NAZIONALE INTERUNIVERSITARIO PER LE TELECOMUNICAZIONI</td>
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</tr>
<tr>
<td>#16</td>
<td>CREATE-NET (CENTER FOR RESEARCH AND TELECOMMUNICATION EXPERIMENTATION FOR NETWORKED COMMUNITIES)</td>
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<tr>
<td>#17</td>
<td>FONDAZIONE BRUNO KESSLER</td>
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<tr>
<td>#18</td>
<td>STICHTING WAGENINGEN RESEARCH</td>
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<tr>
<td>#19</td>
<td>VRUE UNIVERSITEIT BRUSSEL</td>
<td>0.033</td>
</tr>
<tr>
<td>#20</td>
<td>UNIVERSITA DEGLI STUDI DI TRENTO</td>
<td>0.032</td>
</tr>
</tbody>
</table>

8.5 MRTPA Health and Medicine

FP7 topic Health

*Figure 51 Network of R&D institutions in AIR region collaborating in themes that fall under MRTPA Health and Medicine of MRS3 (FP7)*

Health and Medicine R&D networks created under umbrella of FP7 financing in AIR region consists of 152 R&D organizations that have collaborated on 303 R&D projects.

Key actors according to Betweenness indicator are as follows:

1. UNIVERSITA DEGLI STUDI DI MILANO
2. ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON
3. ISTITUTO DI RICERCHE FARMACOLOGICHE MARIO NEGRI
4. ALMA MATER STUDIORUM – UNIVERSITA DI BOLOGNA
5. UNIVERSITA DEGLI STUDI DI PADOVA

Table 20 Rank according to Betweenness centrality indicator and value of indicator for MRTPA Health and Medicine (FP7)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Label</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>UNIVERSITA DEGLI STUDI DI MILANO</td>
<td>0.091</td>
</tr>
<tr>
<td>#2</td>
<td>INSTITUT NATIONAL DE LA SANTE ET DE LA RECHERCHE MEDICALE</td>
<td>0.076</td>
</tr>
<tr>
<td>#3</td>
<td>ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON</td>
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</tr>
<tr>
<td>#4</td>
<td>ISTITUTO DI RICERCHE FARMACOLOGICHE MARIO NEGRI</td>
<td>0.056</td>
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<tr>
<td>#5</td>
<td>ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA</td>
<td>0.049</td>
</tr>
<tr>
<td>#6</td>
<td>UNIVERSITA DEGLI STUDI DI PADOVA</td>
<td>0.049</td>
</tr>
<tr>
<td>#7</td>
<td>UNIVERSITA CATTOLICA DEL SACRO CUORE</td>
<td>0.048</td>
</tr>
<tr>
<td>#8</td>
<td>ERASMUS UNIVERSITAIR MEDISCHE NERZINGHOF ROTTERDAM</td>
<td>0.048</td>
</tr>
<tr>
<td>#9</td>
<td>FONDAZIONE CENTRO SAN RAFFAELE</td>
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<td>#10</td>
<td>UNIVERSITY COLLEGE LONDON</td>
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<tr>
<td>#11</td>
<td>UNIVERSITA VITA-SALUTE SAN RAFFAELE</td>
<td>0.030</td>
</tr>
<tr>
<td>#12</td>
<td>UNIVERSITA DEGLI STUDI DI VERONA</td>
<td>0.029</td>
</tr>
<tr>
<td>#13</td>
<td>KAROLINSKA INSTITUTET</td>
<td>0.028</td>
</tr>
<tr>
<td>#14</td>
<td>ACADEMISCH ZIEKENHUIS LEIDEN</td>
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</tr>
<tr>
<td>#15</td>
<td>ARISTOTELIO PANEPISTIMIO THESSALONIKIS</td>
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</tr>
<tr>
<td>#16</td>
<td>FONDAZIONE PENTA-FOR THE TREATMENT AND CARE OF CHILDREN WITH HIV-ONLUS</td>
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</tr>
<tr>
<td>#17</td>
<td>FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLS</td>
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</tr>
<tr>
<td>#18</td>
<td>KATHOLIEKE UNIVERSITEIT LEUVEN</td>
<td>0.019</td>
</tr>
<tr>
<td>#19</td>
<td>UNIVERSITA DEGLI STUDI DI MODENA E REGGIO EMILIA</td>
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<tr>
<td>#20</td>
<td>UNIVERSITA' DEGLI STUDI DI MILANO-BICOCCA</td>
<td>0.017</td>
</tr>
</tbody>
</table>

H2020 topic Health, demographic change and wellbeing

Figure 52 Network of R&D institutions in AIR region collaborating in themes that fall under MRTPA Health and Medicine of MRS3 (H2020)

H2020 programme brought together 109 R&D organizations from AIR region that created R&D network through collaboration on 148 R&D projects that were funded under H2020 programme.

Key actors in the network that grew out of H2020 programme funding are as follows:

1. ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON
2. UNIVERZA V LJUBLJANI
3. PANEPISTIMIO IOANNINON
4. CONSIGLIO NAZIONALE DELLE RICERCHE
5. ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS

Again, as it was case with R&D networks in Energy and Environment sector, only one key actor kept its position in both networks. Nevertheless, this might be due to fact that H2020 is still ongoing programme, therefore key actors might change considering that not all the projects are mapped in R&D network in question.
OIS-AIR Pilot of Adriatic-Ionian MRS3

Figure 53 Rank according to Betweenness centrality indicator and value of indicator for MRTPA Health and Medicine (H2020)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Label</th>
<th>Value</th>
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</thead>
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<tr>
<td>#4</td>
<td>CONSIGLIO NAZIONALE DELLE RICERCHE</td>
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<td>#5</td>
<td>ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS</td>
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<tr>
<td>#6</td>
<td>FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS</td>
<td>0.055</td>
</tr>
<tr>
<td>#7</td>
<td>INSTITUT JOZEF STEFAN</td>
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<td>UNIVERSITA DEGLI STUDI DI PERUGIA</td>
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<td>#9</td>
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<td>POLITECNICO DI MILANO</td>
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<tr>
<td>#11</td>
<td>ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA</td>
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</tr>
<tr>
<td>#12</td>
<td>KEMIJSKI INSTITUT</td>
<td>0.030</td>
</tr>
<tr>
<td>#13</td>
<td>FACULTY OF MEDICINE, UNIVERSITY OF BELGRADE</td>
<td>0.030</td>
</tr>
<tr>
<td>#14</td>
<td>UNIVERSITY OF NEWCASTLE UPON TYNE</td>
<td>0.029</td>
</tr>
<tr>
<td>#15</td>
<td>ARISTOTEILIO PANEPISTIMIO THESALONIKIS</td>
<td>0.027</td>
</tr>
<tr>
<td>#16</td>
<td>QUEEN MARY UNIVERSITY OF LONDON</td>
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</tr>
<tr>
<td>#17</td>
<td>UMWELTBUNDESAMT</td>
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</tr>
<tr>
<td>#18</td>
<td>UNIVERSITA CATTOLICA DEL SACRO CUORE</td>
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</tr>
<tr>
<td>#19</td>
<td>Masarykova univerzita</td>
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</tr>
<tr>
<td>#20</td>
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</tr>
</tbody>
</table>

CONCLUDING REMARKS

Insights derived from analysis of R&D networks created through collaboration under FP7 and H2020 projects by organizations from member states of Adriatic-Ionian macro-region can be summed up in following manner:

1. Regarding size of R&D networks in Adriatic-Ionian macro-region they vary in size depending on the area of expertise.
2. Largest R&D network is found in area of ICT, whereas least in size are R&D networks in Transport and Mobility.
3. Regarding analysis of key actors/facilitators of the R&D networks in AIR region, they are dominated by R&D organizations from Italy and Greece, with R&D institutions from Slovenia occasionally being among Top 5 key actors of R&D networks in AIR region.
4. R&D networks, to a certain extent, prove to be resilient to change of the Programme (from FP7 to H2020).
5. From visual inspection, it is visible that, there is space, for R&D networks to be enlarged within region, by R&D organizations that participated in FP7 or H2020 projects but were not connected to wider R&D networks.
9. Macro-regional S3 – new concept

Pilot Macro-regional Smart Specialisation Strategy of Adriatic-Ionian Region (MRS3 AIR) is an attempt to provide adequate answer to task set by the OIS-AIR project within the framework of Adriatic-Ionian INTERREG V-B Programme. As an element of a project of broader scope “Establishment of the Open Innovation System of the Adriatic-Ionian region”, pilot MRS3 is envisioned as a document that relies on the existing S3s at regional/national level in project partners (PPs) countries together with innovation/economic development strategies in IPA Partners countries. Main goal is to define key macro-regional development trajectories based on regional S3 and EUSAIR by exploring opportunities for complementarities and common R&D specialisations in the AIR region.

Furthermore, pilot MRS3 strives, by focusing on common challenges and specialisations in the region, to provide common vision of sustainable development of regional Innovation eco-system.

In addition, undertaken activity has task to address various stakeholders within the Adriatic-Ionian region: policy-makers, business-sector and R&D institutions in creating viable innovation eco-system, not only by focusing on commonalities found in various innovation/economic documents, but by also aligning priorities with pillars and priority areas found in EUSAIR.

Cooperation in S3 at macro-regional level could help to explore whether and how S3 priorities envisaged in national and regional strategies differentiate, or are complementary to, their neighbouring countries/regions. It also leads to the creation of strategic linkages to tackle common challenges when engaging in joint S3 initiatives.

Pilot MRS3 will allow partners to take advantage of European regional diversity, as a group of regions might develop strategies based on co-evolution and complementarity.

The macro-regional collaboration will provide a wider choice of combinations of actors, areas and expertise for strategic transnational R&I partnerships in the relevant S3 priority domains.

Raising importance of regionalization is also supported by the fact that value chains are becoming regional and less global. This trend could accelerate as automation reduces the importance of labour costs and increases the importance of speed to market in company decisions about where to produce goods.98

MRS3 has the potential to contribute to the trans-regional competitiveness by interlinking regional and national ecosystems and exploiting complementary skills, research facilities, infrastructure and markets.

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10. MRTPA Agro-Bioeconomy

“The bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries. Its sectors have a strong innovation potential due to their use of a wide range of sciences (life sciences, agronomy, ecology, food science and social sciences), enabling and industrial technologies (biotechnology, nanotechnology, information and communication technologies (ICT), and engineering), and local and tacit knowledge.”

Known for creating particularly strong forward and backward linkages within the economy, looking alone, food sector has often been the focus of economic development strategies for countries in transition. In fact, the growth of agro-processing firms has been associated with strong multiplier effects, with some estimates of the creation of 25 indirect jobs for every job created within an agro-processing firm.

10.1 Global Industry overview

Regarding proposed foresight area later in document, industry overview will focus on describing food sector, nutrition as the sector that is connected to food sector, and associated topics that are part of proposed value chains.

Food production

Food products can be categorized into one of two broad categories, i.e. those with a predominant Crop input or those with a predominant Animal input. Within crop-based products they can be further differentiated between those that utilize cereals and those that utilize horticultural items. Animal products can be differentiated between terrestrial livestock/wild game and aquatic/amphibious animals (Table 21).

Table 21 Division of food sector

<table>
<thead>
<tr>
<th>Type of Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop</td>
<td>Crop products are the result of any cultivated/harvested plant or fungi.</td>
</tr>
<tr>
<td>Cereals</td>
<td>Cereals have traditionally been the focus of agriculture as they have been the most resource efficient source of calories for developing country populations. Such crops notably include; rice, wheat, maize/corn, barley, and other cereal grains.</td>
</tr>
<tr>
<td>Horticulture</td>
<td>Horticultural crops include any crop that is cultivated/harvested for food consumption that is not a staple. It most notably includes fruits, vegetables</td>
</tr>
</tbody>
</table>

and fungi. Note that horticultural items such as flowers or Pyrethrum are also considered horticultural crops but are excluded from this study.

| Animal Products | Animal products are comprised of both terrestrial animals and aquatic/amphibious animal, be it wild caught or domestically reared. |
| Terrestrial Animals | Within terrestrial animals there are both Livestock & Wild Game. Livestock products are those that result from the rearing of land-based animals. The largest sub-categories of livestock products are dairy and meat. Wild game is any animal that are hunted or harvested from the land, although these are not traded globally in significant quantities. |
| Aquatic Amphibious Animals & | This category notably includes Sea and Fresh Water Fish Fishery products and notably includes both farmed marine life (aquaculture) and any product wild caught in water (sea or freshwater). This also includes amphibious creatures like frogs, snails etc. |

Source: Authors

Not surprisingly, the EU’s food and drink industry is the biggest manufacturing sector in terms of jobs and value added. Except that, food sector is a major actor in EU’s well-being and future, plus, looking broader at the value chain, Europe is one of the largest manufacturers of food processing equipment.

Major food value chain activities like farming, food processing and food-related retail and services, account for around 44 million jobs in Europe.

Looking at the revenue in the Food and Beverage segment, it amounts to USD 93,582 million in 2018. Further, revenue is expected to show an annual growth rate (CAGR 2018-2022) of 11.4 %, resulting in a market volume of USD 144,162 million by 2022.¹⁰¹

**Nutrition**

Nutrition is “smarter and advanced” food sector. While it is separated from food sector, when observed logically it is connected and complementary to this sector. Most commonly defined, to include 1) natural health products; 2) dietary supplements; and 3) functional foods, not rarely nutrition falls within few other categories like 1) health and quality of life; 2) pharmaceuticals, biopharmaceuticals, medical equipment and devices; and 3) health services and new methods of preventive medicine and diagnostics.

Global nutraceutical products market was valued at around USD 205.39 billion in 2016 and is expected to reach around USD 294.79 billion by 2022, at CAGR of 6.3 % from 2017 to 2022.¹⁰²

Thus, agro-bioeconomy and nutrition by its description could go along, hand by hand, complementing each other and gaining more value through all value chain activities.

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10.2 Megatrends

Having in mind some of megatrends that are driving economy and changing sectoral operations, OECD Science, Technology and Innovation Outlook 2016,\textsuperscript{103} gives clear direction where certain sectors will go and which technologies will help that shifts.

Megatrend areas that are already present at the market and which will become more and more obvious and thus influencing later proposed foresight area are:

1. demography
2. natural resources and energy
3. climate change and environment
4. globalization
5. health, inequality and well-being.

Above stated trends have significant impact on Agro-Bioeconomy and nutrition sectors in the future. Thus, having megatrends on radar will be extremely important in establishing and managing future business models in given sectors.

Except that, at the same time technologies are rapidly changing and influence all sorts of operations and even nature of doing business in certain sectors. Among ten key and emerging technologies for the future, that are stated in OECD Science, Technology and Innovation Outlook 2016, several can be interesting and important to track.

Internet of Things; big data analytics; artificial intelligence; neuroethologies; nano/microsatellites; nanomaterials; additive manufacturing; advanced energy storage technologies; synthetic biology and blockchain. All these technologies will find multiple purpose in various sectors across economy and some of them, if not already, certainly will have significant impact on agro-bioeconomy and nutrition industry.

10.3 AIR context

Taking into account pillars and topics of existing macro-regional strategy (EUSAIR), and specifics of Adriatic-Ionian macro-region, Agro-Bioeconomy area is in three out of four its pillars.

1. BLUE GROWTH
   • Blue Technology
   • Fisheries and Aquaculture
2. ENVIRONMENTAL QUALITY
   • Marine Environment
     ▪ Environment friendly farming practices
   • Habitats and Biodiversity
     ▪ Environmentally friendly farming practices/organic farming.
3. SUSTAINABLE TOURISM
   • Tourism Offer

OIS-AIR Pilot of Adriatic-Ionian MRS3

- Upgrade of Tourism product in Agriculture & Food processing sector;
- Food supply sector;
- Business and logistic models for food supply sector.

Moreover, exceptional potential for development of the region lies within increased application of the aforementioned technologies to traditional food producing and processing sector within region, specifically to seafood sector.

As, EUSAIR strategy notes, “This involves using the latest research for developing commercial products and internationalizing clusters. Actions may thus help transfer the latest R&D results to seafood processing and new products, helping SMEs develop in the sectors concerned.”104 There is a strong focus on “brain circulation” (mobility of researchers, also between academia and private sector) and on establishment of joint research and innovation platforms in the Region.105

10.4 Eye@RIS3 tool analytics summary

For the purpose of getting better comparison of RIS3 priorities of the whole AIR region and for the PILOT group, Eye@RIS3 tool is used to find commonalities within those NUTS 2 regions (Nomenclature of Territorial Units for Statistics 2 level). Analysis are made through three categorized domains:

1. "Economic Domains" categories are based on the Eurostat’s NACE Rev. 2 sectoral codes and OECD categories.
2. "Scientific Domains" categories are based on the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007).
3. "EU Policy Objectives" includes ten EU-wide policy areas corresponding to the 'Societal Grand Challenges' identified in H2020 and the headline policies in the Innovation Union Flagship Initiative, including Creative and Cultural Industries, KETs, Social Innovation and the Digital Agenda.

Regarding Regional RIS3 data, most frequent subdomains of S3 or other strategic documents given by authorities are (frequencies are in brackets):

A. Economic subdomains:
   1. A.01 Crop and animal production, hunting and related service activities (30)
   2. C.10 Food production (22)
   3. C.11 Beverages (18)
   4. A.03 Fisheries and aquaculture (14)
   5. J.63 Information service activities (10).

B. Scientific subdomains:
   1. 08.76 Food productivity and technology (29)
   2. 06.41 Manufacture of food products (22)
   3. 06.42 Manufacture of beverages (21)
   4. 08.73 Agriculture, forestry and fishery (21)

104 European Commission (2014a), op. cit.
5. 12.098 Agriculture, forestry, fishery, animal and dairy sciences (20).

C. Policy Objective subdomains:
   1. J.67 Sustainable agriculture (20)
   2. G.48 Food security and safety (13)
   3. E.39 Industrial biotechnology (9)
   4. J.61 Bioeconomy (9)
   5. J.63 Eco-innovations (7).

Regarding PILOT group RIS3 data, most frequent subdomains of S3 or other strategic documents given by authorities are:

A. Economic subdomains:
   1. A.01 Crop and animal production, hunting and related service activities (3)
   2. C.10 Food production (3)
   3. C.11 Beverages (2)
   4. E.36 Water collection, treatment and supply (2)
   5. J.62 - Computer programming, consultancy and related activities (1).

B. Scientific subdomains:
   1. 08.76 Food productivity and technology (5)
   2. 08.73 Agriculture, forestry and fishery (4)
   3. 06.41 Manufacture of food products (3)
   4. 06.42 Manufacture of beverages (3)
   5. 08.74 Animal and dairy science (2).

C. Policy Objective subdomains:
   1. J.67 Sustainable agriculture (4);
   2. J.61 Bioeconomy (4)
   3. E.39 Industrial biotechnology (2)
   4. G.48 Food security and safety (2)
   5. J.68 Sustainable energy and renewables (2).

Further, by exploring and analysing keywords from EUSAIR and each S3 document of the PILOT group within MRTPA Agro-Bioeconomy it can be identified and noted those that fit best to prior listed most frequent scientific and policy objective subdomains (showed in bold):

EUSAIR: blue technologies; sea-food R&D; innovative fishing and aquaculture techniques; environmentally friendly farming practices; upgrade of Adriatic-Ionian tourism products; connecting local agricultural.

FRIULI-VENEZIA GIULIA: functional foods; ready-to-eat foods; food production chain; food processing technologies; direct traceability of foods; recovery and reuse of by-products; industrial design techniques; innovative systems for the conservation of products; active and intelligent packaging systems; innovative techniques for the chemical analysis.

BASILICATA: water purification, optimization of water use in agriculture; reuse of wastewater in agriculture; genomic researches methods for certification, traceability and conservation; innovative
diagnostic and control methods; rapid diagnosis of chemical and biological contaminants; exploitation of biomass, by-products and waste from agricultural production and the food industry; improve and consolidate the relationships between local producers and buyers.

CENTRAL MACEDONIA: new specialized food; genomics technologies; innovative and functional packaging; environmental footprint; functional foods and healthy foods.

SLOVENIA: functional foods; sustainable agricultural production.

CROATIA: integrated and organic agriculture innovations including plant protection; innovative technologies and processes for high quality food production; food safety; preservation of products; integrated supply and value chain solutions; innovative processing of by-products; development of added value aquaculture products; natural health products; dietary supplements; functional and enriched food.

SERBIA: agriculture & food

ALBANIA: agriculture, food & biotechnology

10.5 Foresight area proposal

Concerning above stated, few development trajectories has been nominated (or sub-thematic priority area) for foresight activity:

Healthy and functional food (Blue) – emphasis on seafood (including freshwater food)

Healthy and functional foods – by definition, functional food is whole foods along with fortified, enriched or enhanced foods that have a potentially beneficial effect on health when consumed as part of a varied diet on regular basis at effective levels based on significant standard of evidence.  

Basically, that is the food that provide a health benefit in addition to macro and micronutrients. Certain food can be functional by itself, containing bigger amount of ingredients that have positive health effects (e.g. whole grains, nuts, fruits), or it can be regular food that is enriched with certain ingredients and thus have positive health effects (e.g. probiotic yogurt, omega 3 fatty acids or protein enriched products). Except broad usage and general health benefits, functional food can be adjusted and modified for different groups of people with specific nutrition requirements.

Based on proposed macro regional trajectory and described trends within EUSAIR, foresight area should be based on few of “more SME based” solutions and skills for healthy and functional food. Foresight areas subtopics might include:

1. Advanced processing and packaging solutions
2. Food safety & traceability
3. Smart solutions for personalized diet.

Advanced processing and packaging solutions – key to maintain food quality and perishability.

**Food safety and traceability** – create important factor for public health in cases of preparedness, response, recovery and prevention of certain food related issues and problems.

**Smart solutions for personalized diet** – make personalization possible for broad scope of people, enhance its quality, and enable quick an affordable monitoring and adjustment.

<table>
<thead>
<tr>
<th>Rationale for selection of above mentioned development trajectory has stronghold in:</th>
</tr>
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<tbody>
<tr>
<td>a) Prior development documents of the macro-region (notably EUSAIR strategy).</td>
</tr>
<tr>
<td>b) Smart Specialisation Strategies of regions and countries included in devising pilot MRS3.</td>
</tr>
<tr>
<td>c) Indicators supporting specialisation of Adriatic-Ionian macro-region in food producing and processing sector.</td>
</tr>
<tr>
<td>d) Agro-Bioeconomy related scenarios from Glimpses of the future from the BOHEMIA study.</td>
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</table>

10.6 R&D topics

Horizon Europe R&D foresight – BOHEMIA study is the main EU strategic foresight study in support of the Commission’s proposal for Horizon Europe – the EU framework programme for research and innovation 2021-2027.

Important R&D topics can be associated with foresighted R&D topics from BOHEMIA study:

1. developing and testing new circular bio-economic processes;
2. understanding and managing systems of sustainable agriculture and aquaculture;
3. villages as resources and processing hubs for energy and food businesses (agro-center with resources and processing);
4. organizational and social innovations for optimizing food supply systems from farming to consumption;
5. e-health solutions including telemedicine, measuring health data and transfer;
6. healthy and sustainable diets;
7. personalized disease prevention for every-day life (including personalized diet and physical activity programs);
8. biotechnology research for agriculture, food production, and medicine.

Several other important R&D topics can be associated in addition to foresighted R&D topics from BOHEMIA study:

1. innovative technologies and processes for high quality food production;
2. food safety;

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3. preservation of products;
4. integrated supply and value chain solutions;
5. innovative processing of by-products;
6. ecosystem based approach in the fisheries instead of single stock approach;
7. smart fishing gears and protection of critical habitats; protection of marine areas;
8. impact of climate change and invasive species to the ecosystem and fisheries;
9. post harvesting methods to maintain the value of catch and diversification of fishing activities;
10. introduction of new species and use of environmentally friendly technology;
11. development of added value aquaculture products;
12. development of innovative uses for undesired catches and new breeding technologies;
13. aquaponics;
14. natural health products;
15. dietary supplements;
16. functional and enriched food.

10.7 Supporting technologies (KETs)

As regards future technologies, several foresight studies have indicated that the current set of KETs are still among the technologies that are most likely to disrupt economies and societies over the next 10-15 years. The OECD, based on several technology foresight exercises in its member countries and Russia, identified 40 key and emerging technologies that might best tackle the various ‘grand challenges’ the world faces (e.g. ageing, climate change, natural resource depletion, health inequality).

The most applicable key enabling technologies (KETs) that are proposed as most supportive ones for the Agro-Bioeconomy foresighted area proposal are given in the following list.

OPTION A – KETs (Re-finding Industry)

I) PRODUCTION TECHNOLOGIES
A) Advanced Manufacturing Technologies
1) Smart Manufacturing / Industry 4.0
2) Robotics / Human machine interaction
3) Process industry (processing of novel materials, structures, etc.)
4) Monitoring and control
5) High performance computing/cloud-based simulation services
6) High-performance production (flexibility, productivity, precision and zero defect)
7) High-performance, high precision processing
8) Intelligent/ sensor-based equipment
B) Advanced materials and Nanotechnologies
1) High performance, smart sustainable materials

110 OECD (2016), op. cit.
2) Nanomaterials
3) Nanotechnology
4) Biomaterials
C) Life science technologies
1) Industrial biotechnology
2) High throughput biology
3) Automation for biology

II) DIGITAL TECHNOLOGIES
A) Micro/Nano electronics and Photonics
1) IoT
2) Smart/Intelligent sensors
B) Artificial intelligence
1) Data generation and handling
2) Big data analytics
3) Machine learning and deep learning
4) Smart robots.

OPTION B – KETs (OECD)\(^{112}\)

A) DIGITAL
1) Internet of Things (IoT)
2) Big data analytics
3) Artificial intelligence (AI)
4) Blockchain
5) Robotics
6) Cloud computing
B) BIOTECHNOLOGIES
1) Bioinformatics
2) Health monitoring technology
C) ADVANCED MATERIALS
1) Nanomaterials
2) Functional materials.

\(^{112}\) OECD (2016), op.cit.
11. MRTPA Energy and Environment

In last decades between two UNFCCC milestones, Kyoto and Paris\textsuperscript{113}, energy and environment sectors globally merged into one ecosystem that is more complex and more interrelated than ever before and will be more in the future. The area of energy and environment is diverse and differs regarding its innovation, knowledge and market features. However, for this purpose and regarding to later described trends and like in analysis of the national Smart Specialisation Strategies in Central Europe\textsuperscript{114}, this thematic area can generally be distinguished across three sub-areas:

1. fossil fuels industry (oil, coal, gas);
2. renewable industry (photovoltaic, wind, biomass, hydropower);
3. environmental industries and services.

Each of these areas operates in different modes of innovation, have somewhat different knowledge bases and market structures. Last two merged into “environmental technologies” or “environmental-friendly technologies” and such make notable economic significance of environmental protection and climate action. Since sole fossil fuel industry has less attractive future especially within innovation and research potentials and trends, following presentation on thematic area will focus on other two as environmental technology and resource efficiency segment.

11.1 Global Industry overview

The global market for environmental technology and resource efficiency is very complex. The market breakdown according to six main lead markets is shown on following list:\textsuperscript{115}

1. Environmentally friendly power generation, storage and distribution
   - Renewable energy
   - Eco-friendly use of fossil fuels
   - Storage technologies
   - Efficient grids
2. Energy efficiency
   - Energy-efficient production processes
   - Energy-efficient buildings
   - Energy-efficient appliances
   - Cross-sector components
3. Material efficiency
   - Material-efficient processes
   - Cross-application technologies
   - Renewable resources
   - Protection of environmental goods

\textsuperscript{113} UNFCCC, https://unfccc.int/process, retrieved: 21.1.2019
\textsuperscript{114} Radosevic, S., Walendowski, J. (2016), op. cit.
4. Sustainable mobility\textsuperscript{116} 
   - Alternative drive technologies 
   - Renewable fuels 
   - Technologies to increase efficiency 
   - Transportation infrastructure and traffic management 

5. Waste management and recycling 
   - Waste collection, transportation and separation 
   - Material recovery 
   - Energy recovery 
   - Landfill technologies 

6. Sustainable water management 
   - Water production and treatment 
   - Water system 
   - Wastewater cleaning 
   - Wastewater treatment methods 
   - Efficiency gains in water usage.

Volume of the global market for environmental technology and resource efficiency exceeded the EUR 3 trillion mark in 2016, ending the year at EUR 3,214 billion.\textsuperscript{117} The volume of the market for environmental technology and resource efficiency will continue to grow. By 2025, the six lead markets listed above are estimated to be worth EUR 5,902 billion in total.\textsuperscript{118} This figure is based on forecasts that this cross-sector industry will grow by an average (CAGR) of 6.9% per year in the period from 2016 through 2025.\textsuperscript{119} According to the numbers and analysis of the market potential, this segment is a good area for fostering innovation, research and development within AIR region through various aspects of analysed S3 documents.

11.2 Megatrends

Energy and environment sectors share some influences from global megatrends such as population growth (mainly in developing countries), population ageing (in advanced countries), urbanisation and sustainability pressure. Those megatrends drive Energy and Environment sectors toward global energy transition and sector specific megatrends:\textsuperscript{120}

1. the end of the fossil era has begun; 
2. the energy future is renewable; 
3. the energy future is decentralised; 

\textsuperscript{116} Sustainable mobility in the list is subject of other thematic priority area and will not be further analysed in this document under energy and environment area.


\textsuperscript{118} Ibid.

\textsuperscript{119} Ibid.

4. the energy future is digital.

In addition, changes in so called “environmentally friendly industries” globally signal the arrival of new business models and product categories which allow companies to capture value and to compete on quality and product differentiation. These trends include: the growth of renewable energy; distributed generation; microgrids; innovative energy storage technologies, smart and efficient grids, energy efficient materials, waste separation and recycling, and wastewater management.

11.3 AIR context

AIR region and its EUSAIR strategy include Energy and Environment area into its all four pillars through regional needs and indicative actions. Related EUSAIR areas per pillar are as follows.

1. CONNECTING THE REGION
   - Electricity interconnection
   - Gas pipelines

2. BLUE GROWTH
   - Green shipbuilding (lower emissions, shift from fossil fuels)

3. ENVIRONMENTAL QUALITY
   - Marine litter recycling (environment protection and circular economy)
   - Coastal and maritime biodiversity (environment protection)
   - Removal of grey infrastructure (environment protection)

4. SUSTAINABLE TOURISM
   - Business opportunities in environmental technology (energy efficiency, lower CO₂ footprint in products and services for tourism, environment protection).

Regarding sole energy sector, EUSAIR has two main contexts: energy networks and energy markets. Both contexts are focused on infrastructure or transnational coordination through following needed activities:

1. cross-border electricity interconnections;
2. enhance security of gas supply (connections for TAP, IAP and LNG ports and infrastructure);
3. support the establishment of a well-functioning electricity market;
4. remove barriers for cross-border investments.

Investment in infrastructure is crucial for achieving market competition for both electricity and gas, while development of freely accessible energy trading/auctioning platforms is necessary to enhance market competition.

Foreseen and identified infrastructure projects are needed to fulfil regional energy development and future energy needs, but R&D and SME communities should not wait with R&D and innovation activities for bringing new products and services in energy and environment area. Sources of energy are shifting increasingly toward renewables and this shift is driven largely by two trends: reductions in the costs of energy generated by renewables and social and political commitment to environmental protection and emissions reduction. Among all renewable sources, hydropower contributes the most
in AIR region with 37 GW of installed power that counts nearly 15 % of total Europe’s hydropower.\textsuperscript{121} “Since Europe’s hydro potential is largely tapped, the increase in renewables comes from wind, solar and biomass generation”.\textsuperscript{122} AIR has the same profile of such renewable share.

The Mediterranean Sea has a very high natural potential for the exploitation of renewable energy sources. In particular solar thermal and photovoltaic (PV) are the most used technologies in the Adriatic-Ionian Region not only because of its ideal geographic position and natural potential but also for the best incentives system these technologies benefit from. Even wind and marine energy represent promising sectors although different barriers – both structural and administrative – still need to be overcome (high investment costs, uncertainty of the legal-political framework, grid connections limits, and social acceptability).

Despite the great energy potential of the Mediterranean, the exploitation of renewable energy sources is still limited and many efforts have to be undertaken to pave the way to diffuse Blue Growth by boosting the renewable energy sector.\textsuperscript{123}

Further, wherever is possible, energy efficiency improvements should be considered with a view to enhancing security of supply and to achieving a better degree of energy autonomy. Moreover, the participation of the demand side is particularly valuable for matching varying supply patterns and accommodating renewable energy sources in the system.

11.4 Eye@RIS3 tool analytics summary

For the purpose of getting better comparison of RIS3 priorities of the whole AIR region and for the PILOT group\textsuperscript{124}, Eye@RIS3 tool is used to find commonalities within those NUTS 2 regions having Energy and Environment as one of its S3 priority domains. Analysis are made through three categorized domains:

1. "Economic Domains" categories are based on the Eurostat's NACE Rev. 2 sectoral codes and OECD categories.
2. "Scientific Domains" categories are based on the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007).
3. "EU Policy Objectives" includes ten EU-wide policy areas corresponding to the 'Societal Grand Challenges' identified in H2020 and the headline policies in the Innovation Union Flagship Initiative, including Creative and Cultural Industries, KETs, Social Innovation and the Digital Agenda.

\textsuperscript{124} PILOT group consist of Friuli-Venezia Giulia, Basilicata, Slovenia, Croatia, Serbia, Albania and Central Macedonia
Regarding **Regional RIS3 data**, most frequent subdomains of S3 or other strategic documents given by authorities are (frequencies are in brackets):

A. **Economic subdomains:**
   1. D.35 Electricity, gas, steam and air conditioning supply (17)
   2. E.38 Waste collection, treatment and disposal activities; materials recovery (9)
   3. M.72 Scientific research and development (8)
   4. E.39 Remediation activities and other waste management services (6)
   5. C.26 Computer, electronic and optical products (4).

B. **Scientific subdomains:**
   1. 05.37 Renewable energy sources (15)
   2. 05.33 Energy production and distribution efficiency (13)
   3. 05.32 Energy efficiency - consumption (11)
   4. 05.31 Energy conservation (9)
   5. 05.36 Other power and storage technologies (8).

C. **Policy Objective subdomains:**
   1. J.68 Sustainable energy and renewables (19)
   2. J.71 Waste management (8)
   3. J.63 Eco-innovations (7)
   4. J.65 Resource efficiency (6)
   5. J.69 Sustainable land and water use (5).

Regarding **PILOT group RIS3 data**, most frequent subdomains of S3 or other strategic documents given by authorities are (frequency is noted in parentheses at the end of subdomains names):

A. **Economic subdomains:**
   1. D.35 Electricity, gas, steam and air conditioning supply (4)
   2. E.38 Waste collection, treatment and disposal activities; materials recovery (2)
   3. M.72 Scientific research and development (2)
   4. E.39 Remediation activities and other waste management services (2)
   5. E.36 Water collection, treatment and supply (2).

B. **Scientific subdomains:**
   1. 05.33 Energy production and distribution efficiency (3)
   2. 05.32 Energy efficiency – consumption (3)
   3. 05.37 Renewable energy sources (2)
   4. 05.31 Energy conservation (2)
   5. 05.36 Other power and storage technologies (2).

C. **Policy Objective subdomains:**
   1. J.68 Sustainable energy and renewables (4)
   2. J.63 Eco-innovations (3)
   3. J.70 Sustainable production and consumption (3)
   4. J.69 Sustainable land and water use (3)
   5. J.65 Resource efficiency (3).
Further, by exploring and analysing keywords from EUSAIR and each S3 document of the PILOT group within MRTPA Energy and environment it can be identified and noted those that fits best to prior listed most frequent scientific and policy objective subdomains (showed in bold):

**EUSAIR:** green sea mobility; green shipbuilding clusters; cross-border electricity interconnections; gas pipelines; well-functioning electricity market; marine litter recycling; waste management, wastewater treatment; decreasing fertilizer use; green infrastructure and removal of grey infrastructure; new business opportunity in environmental technology.

**FRIULI-VENEZIA GIULIA:** technologies for energy efficiency of buildings; cloud computing technologies (smart grids); technologies for management and production of energy and the management of the on-board energy balance; technologies reducing the carbon footprint of the construction and management of maritime products; processes for reducing the environmental impact of maritime transport; new materials and applications of environmentally sustainable materials, for the lightening of maritime means and energy saving.

**BASILICATA:** environmental impact of construction products; smart buildings; renewable sources and storage systems; biomass and waste; energy efficiency; smart grids; bio-fossil blending.

**CENTRAL MACEDONIA:** second-generation biofuels; CO₂ capture; wind turbines; photovoltaic; solar installations; fuel cells; recycling and treatment of solid and liquid waste; hazardous waste treatment technologies; biomass; urban wastewater treatment.

**SLOVENIA:** energy efficiency and self-sufficiency of buildings; sustainable biomass transformation; reuse of waste; energy based on alternative sources; smart grids.

**CROATIA:** components and systems connected to renewable energy sources; advanced energy storage systems; energy management systems; monitoring of energy efficiency and CO₂ reduction; energy management systems; support for the functioning of energy markets at microgrid level, smart grids and smart cities and complex energy systems; biogas technology; energy saving technologies; foresight and mitigation innovations for environmental pollution.

**SERBIA:** energy & energy efficiency; environmental protection & countering climate change.

**ALBANIA:** water & energy; biodiversity & environment.

All aspects of correlations between elements from regional strategies of the PILOT Group are shown through their aimed policy objectives, chosen science domains and most common keywords from thematic area descriptions. Those correlations funnelling down to common macro-regional R&D trajectory of Energy and Environment thematic area in broader aspect of environmentally friendly power generation (renewables), storage, distribution and energy efficiency topics. Blue growth aspect can be also included in chosen trajectory.

### 11.5 Foresight area proposal

**Integration of distributed energy resources (DER)**

The traditional model of energy distribution is one in which power is transmitted from centralized stations to end users over great distances. The conventional grid model emerged in the late 19th
century and by using transformers for step up voltage after electric power being generated for the purpose of transmit the electricity over large distances, and then step down the voltage again before distributing it to the final users. Electricity is generated in large, centralized plants that are often located at large geographical distances from end users.

However, after decades where centralized grids have prevailed, the increasing emphasis on renewable energy is driving an unavoidable shift toward distributed generation. The rise of renewable generation marks a transition from the traditional AC grid toward a more decentralized energy system. Instead of a transmission and distribution network radiating from a centralized power station, today’s energy networks incorporate both traditional energy sources and an array of decentralized energy resources (DER) that reflects the increasing deployment of wind, geothermal, CSP and especially solar PV generation. (The latter represents the most dispersed renewable technology of all.) As the share of RES in the total energy mix rises, the prevalence of distributed generation will only grow.

Based on proposed macro regional trajectory and described trends within EUSAIR energy networks pillar (besides large regional interconnecting infrastructural projects), foresight area should be focused on few of “more SME based” solutions and skills for integrating renewable resources by parallel managing in demand and energy efficiency through big data and digitalization of the sector. Foresight areas (subtopics) might include as follows:

1. Integration of renewable energy sources, energy storage systems and demand-side management systems
2. Data based services and solutions for energy efficiency planning (including for infrastructure upgrading or retrofitting)
3. Smart grid solutions.

**Integration of renewable energy sources, energy storage systems and demand-side management systems** – products, solutions and knowledge for integration of distributed energy sources into networks are needed for achieving a secure and sustainable energy mix in both populated areas and remote communities (islands) or even on commercial buildings or just on family house level. The products in this segment include distributed generation and the associated control systems and technologies to facilitate such networks. The products are often characterized by ‘smart’ technologies to smooth consumption over time and to respond dynamically to energy availability and prices—even from minute to minute.

**Data based services and solutions for energy efficiency planning (including for infrastructure upgrading or retrofitting)** – energy savings services or solutions based on data collecting through remote smart metering and cloud computing (including maintenance and asset repair packages) are expected to grow globally over the next 5 to 10 years. Market for such services is broad and it will cover segments from individual customers and homeowners to commercial, industrial, and municipal organizations.

**Smart grid solutions** – smart grids comprise a broad mix of technologies for modernising electricity networks. Improved monitoring, control and automation technologies can help to enable new business models while unlocking system-wide benefits including reduced outages, improved response times, deferral of investment in the grids themselves and the integration of distributed energy resources. At the end-user level, smart grids can enable demand flexibility and consumer participation in energy
systems, including through demand response, electric vehicle charging and self-produced distributed generation and storage (IAE on Smart grids). Those technologies on smart grids applies on Blue economy areas as well like islands, ports, coastal infrastructure and multi-purpose offshore platforms.

Rationale for selection of above mentioned development trajectory has stronghold in:

a) Prior development documents of the macro-region (notably EUSAIR strategy).
b) Smart Specialisation Strategies of regions and countries included in devising pilot MRS3.
c) In indicators supporting specialisation of Adriatic-Ionian macro-region in energy and environment sector.
d) Energy and environment related scenarios from Glimpses of the future from the BOHEMIA study.\textsuperscript{125}
e) \textit{Re-finding Industry – Defining Innovation}, Report from the High-Level Strategy Group on Industrial Technologies.\textsuperscript{126}

\subsection*{11.6 R&D topics}

Horizon Europe R&D foresight – BOHEMIA study is the main EU strategic foresight study in support of the Commission’s proposal for Horizon Europe – the EU framework programme for research and innovation 2021-2027.\textsuperscript{127}

Important R&D topics can be associated with foresighted R&D topics from BOHEMIA study:

1. methods, practices and solutions to promote energy saving and reduction of energy consumption;
2. developing optimal regulatory framework and incentives for long term systems change toward 100\% renewables;
3. smart grids deployment, including aspects such as infrastructure, demand response services and blockchains;
4. research and exploitation of energy harvesting;
5. research on batteries;
6. environmental impact assessment;
7. eco-efficient materials;
8. research focusing on renewable materials and their split up/recycling in early development process;
9. building models for a sustainable circular economy based on renewable resources and renewable energy;
10. inquiry into and development of solutions for environmental, social and economic impact assessment;

\textsuperscript{126} European Commission, Directorate-General for Research and Innovation (2018), op. cit.
11. exploring the intersection of ecology and technology, and in particular using technology for sustainable practices;
12. science-based approaches to regulations and policy-making;
13. research on smart grid management and on the opportunities for cross-domain solutions (Smart Mobility, Smart City and Smart Grids).

Several other important R&D topics can be associated in addition to foresighted R&D topics from BOHEMIA study:

1. development of new and improvement of existing primary and secondary equipment for electrical energy systems (primary equipment: turbines, generators, motors, transformers, switchgears, transmission lines and cables, secondary energy equipment: management, measurement, protection, supervision, guidance);
2. new technologies and improvements related to power plants, substations, components and systems connected to renewable energy sources;
3. advanced energy storage systems;
4. diagnostic and better management of energy equipment;
5. energy management systems for planning, investment, real time management and monitoring of energy efficiency and CO$_2$ reduction;
6. process and embedded computer automation and control processes;
7. systems for energy management and support for the functioning of energy markets at levels of microgrids, smart grids and smart cities;
8. advanced conventional energy solutions;
9. application of smart grids and complex energy systems;
10. energy-efficient interconnected and universal lighting;
11. sustainable conversion of biomass into energy;
12. biogas technology for production of electricity and heat;
13. energy saving technologies combined with effective usage of renewable energy capacities;
14. technologies reducing harmful industry emissions of CO$_2$ through applying innovative new technologies and solutions;
15. development of technologies and equipment for protection of sea;
16. technologies for energy saving combined with efficient use of renewable energy capacities.

11.7 Supporting technologies (KETs)

As regards future technologies, several foresight studies have indicated that the current set of Key enabling technologies (KETs) are still among the technologies that are most likely to disrupt economies and societies over the next 10-15 years. The OECD, based on several technology foresight exercises in its member countries and Russia, identified 40 key and emerging technologies that might best tackle the various ‘grand challenges’ the world faces (such as ageing, climate change, natural resource depletion, health inequality)$^{128}$. 

$^{128}$ OECD (2016), op. cit.
The most applicable key enabling technologies (KETs) that are proposed as most supportive ones for the Energy and Environment foresighted area proposal are given in the following list.

**OPTION A – KETs (from Re-finding Industry)**

I) **PRODUCTION TECHNOLOGIES**
   A) Advanced Manufacturing Technologies
      1) Process industry (processing of novel materials, structures, etc.)
      2) Monitoring and control
      3) High performance computing / cloud-based simulation services
      4) Intelligent/ sensor-based equipment
      5) Green propulsion technologies
   B) Advanced materials and Nanotechnologies
      1) High performance, smart sustainable materials
      2) Materials for energy storage and generation
      3) Lightweight technologies

II) **DIGITAL TECHNOLOGIES**
   A) Micro/Nano electronics and Photonics
      1) IoT
      2) Smart/Intelligent sensors
   B) Artificial intelligence
      1) Data generation and handling
      2) Big data analytics
      3) Machine learning and deep learning
      4) Software technologies
      5) Decision making technologies

III) **CYBER TECHNOLOGIES**
   A) Security
      1) Data protection and privacy
      2) IoT cyber security solutions
   B) Connectivity
      1) Cyber Physical Systems
      2) Blockchain.

**OPTION B – KETs (OECD)**

1. **DIGITAL**
   1) Internet of Things (IoT)
   2) Big data analytics
   3) Artificial intelligence (AI)
   4) Blockchain
   5) Cloud computing

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130 OECD (2016), op. cit.
6) Photonics and light technologies

2. ENERGY + ENVIRONMENT
   1) Fuel cells
   2) Hydrogen energy
   3) Photovoltaics
   4) Wind turbine technologies
   5) Marine and tidal power technologies
   6) Power microgeneration
   7) Smart grids
   8) Electric vehicles
   9) Carbon capture and storage
   10) Advanced energy storage technologies

3. ADVANCED MATERIALS
   1) Nanomaterials
   2) Additive manufacturing
   3) Carbon nanotubes and graphene.
12. MRTPA Transport and Mobility

The transport and mobility market has been one of priorities of majority of European countries and is highlighted as such as the RIS3 priority.

Overall level of potential cooperation between stakeholders in transport and mobility domain is considered strong, especially in the automotive sector among business sector and scientific research institutions. Industry itself is highly globalized with strong competition but giving enough space for industry newcomers due to recent disruptive industry trends.131

According to the EUSAIR, improving connectivity within the Region with the rest of the Europe is set as overall objective of pillar 2 “Connecting the Region” due to huge macro-regional infrastructure disparities. Strategy states that “better use of intermodal transport will reduce the costs of delivering goods in Central and Eastern Europe, improve the eco-balance and restore the competitive position of the North Adriatic ports as natural gateways to Central and Eastern Europe.”132

12.1 Global industry overview

Transport and mobility are important areas of moving people and providing the goods and services by road, rail, air and water, which are foundations of economic life. Transport and mobility make substantial contributions to meet global challenges in relation to smart, green and integrated transport.

The future of smart mobility is likely to be very different from present perspective. The individual traveller is at the center of this new eco-system. Perspective is in multi-modal commuting, combining door-to-door solutions and on demand using dedicated mobility platforms to manage various transport solutions. Smart mobility solution providers will enable door-to-door, rather than station-to-station or point-to-point travel. Travelers would have many possibilities and choices of commuting, and the boundaries among private, shared, and public transport would be blurred. Electric vehicles (EVs) would become more common tool for transport encouraged by consumer interest, economics, incentives and legal requirements ensuring the first and the last mile connectivity. New mobility would be powered by smart software platforms that manage multimodal traffic flows and deliver mobility as a service. New mobility would be delivered through a combination of self-driving, shared vehicles, with high-quality public transit as the backbone including links to other transport modes by rail, air and water.

Market disruptions would heavily affect transport industry in all sectors (road, rail, air and water). Automotive industry is especially affected by expected upcoming market rollout for connected-autonomous-electric vehicles with higher utilization designed for urban mobility would likely trigger changes in car design and production. Road infrastructure will need to have digitalized supportive solutions in order to accommodate new generation of vehicles and to optimize and manage present road networks while raising safety and providing new business models in relation to shared economy services.

According to McKinsey report\textsuperscript{133}, “in 2010, the inconceivable amount of EUR 6.4 trillion was spent on the transport of humans and goods, almost EUR 1,000 per person on the planet. This global market for mobility effectively quadrupled in the last 40 years, growing at 3.8 % p.a., outpacing world GDP (3.1 %). Mobility now accounts for 13 % of global GDP. Within the mobility market, however, growth trajectories have diverged. From 1970 to 2010 the amount spent on fuels and other operating resources grew by a factor of 16 largely driven by an oil price increase from USD 10.1 per barrel in 1970 to USD 79.5 per barrel in 2010. Also, mobility services, enabled by modern logistics solutions, grew by a factor of 8, and long-haul transportation, driven by globalization grew five times.”

12.2 Megatrends

Transport and mobility areas are affected by several global megatrends and common to all countries and regions particularly naming most important:

1. Rapid urbanization within big cities and trade growth – growth in population has created big demand for personal mobility. Despite extensively grown transport infrastructure, growth is not adequate to meet the demand. There is a need to reduce congestions and greenhouse gasses.

2. Traffic safety – increasing transport and mobility needs leads to increased traffic fatalities thus demanding new solutions to reduce traffic accidents.

3. Climate change – one of the major global challenge and greenhouse gas (GHG) emissions from transport are a key contributor to this. The transport sector accounts for about 23 % of global energy related CO\textsubscript{2} emissions and its share of global energy use is increasing more rapidly than in other sectors.\textsuperscript{134}

4. Technology advances – electrification, digitalization, shared mobility, autonomy and wireless communication technologies based on sensors and high-speed data transfer are cumber stone for evolution in road, rail, air and naval smart transport systems.

12.3 AIR context

AIR region and its EUSAIR include Transport and mobility area into its all four pillars through regional needs and indicative actions. Related EUSAIR areas per pillar are as follows.

1. CONNECTING THE REGION
   - Maritime transport
   - Intermodal connection to hinterland

2. BLUE GROWTH
   - Green sea mobility and green shipbuilding (lower emissions, shift from fossil fuels).

Maritime transport – traffic monitoring and management is big challenge in whole region with focus on ports as key figure. Main identified challenges are developing port activities/services/operations


and optimizing port interfaces and infrastructures in order to boost connections for freight and passenger transport across the region with the emphasis on clean short sea shipping in the touristic Adriatic Sea basin.

**Intermodal connection to hinterland** – promoting sustainable multimodal transport between coastal area and inland corridors in order to boost transport of freight and passengers. **Road transport** is challenged with the completion of the Adriatic and Ionian Motorway in order to boost tourism with emphasis on environmental impacts. **Rail transport** had long period of under-investing in infrastructure and rolling stock with both freight and passenger traffic volumes in negative trends enhanced by excessive waiting times and procedures at numerous border crossings. **Air transport** may present cheapest way to increase intraregional link but is facing lack of intraregional connectivity. **Sea-based transport** aims at developing motorways of the sea, i.e. integrated management of the whole logistic chain by improving road and rail infrastructure linking ports with islands and hinterland by improved infrastructure enhanced with Intelligent transport systems (ITS) solutions.

**Green sea mobility and green shipbuilding (lower emissions, shift from fossil fuels)** – promotion and development of new materials, sensor technologies shore-based supply of electricity for vessels in ports and to innovative propulsion modes and fuels and strengthening of “green” shipbuilding macro-regional clusters.

### 12.4 Eye@RIS3 tool analytics summary

For the purpose of getting better comparison of RIS3 priorities of the whole AIR region and for the PILOT group, Eye@RIS3 tool is used to find commonalities within those NUTS 2 regions having transport and mobility as one of its S3 priority domains. Analysis were made through three categorized domains:

1. "**Economic Domains**" categories are based on the Eurostat’s NACE Rev. 2 sectoral codes and OECD categories.
2. "**Scientific Domains**" categories are based on the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007).
3. "**EU Policy Objectives**" includes ten EU-wide policy areas corresponding to the 'Societal Grand Challenges' identified in H2020 and the headline policies in the Innovation Union Flagship Initiative, including Creative and Cultural Industries, KETs, Social Innovation and the Digital Agenda.

Regarding **Regional RIS3 data**, most frequent subdomains of S3 or other strategic documents given by authorities are (frequency is noted in parentheses at the end of subdomains names):

**A. Economic subdomains**:
1. H.49 Land transport and transport via pipelines (6)
2. C.30 Other transport equipment (5)
3. C.29 Motor vehicles, trailers and semi-trailers (4)
4. H.50 Water transport (4)
5. H.52 Warehousing and support activities for transportation (3).

**B. Scientific subdomains**:
1. 04.28 Transport systems (8)
Regarding **PILOT group RIS3 data**, most frequent subdomains of S3 or other strategic documents given by authorities are (frequency is noted in parentheses at the end of subdomains names):

**A. Economic subdomains:**
1. C.30 Other transport equipment (4)
2. C.29 Motor vehicles, trailers and semi-trailers (3)
3. C.28 Machinery and equipment n.e.c. (2)
4. C.26 Computer, electronic and optical products (2)
5. H.49 Land transport and transport via pipelines (2).

**B. Scientific subdomains:**
1. 04.28 Transport systems (3)
2. 06.61 Manufacture of other transport equipment (3)
3. 04.23 Civil engineering (2)
4. 05.32 Energy efficiency - consumption (2)
5. 12.102 Engineering Sciences - Slovenia (1).

**C. Policy Objective subdomains:**
1. J.66 Smart green & integrated transport systems (3)
2. E.37 Advanced manufacturing systems (2)
3. E.38 Advanced materials (2)
4. B.14 Shipbuilding & ship repair (1)
5. H.53 New or improved service products (commodities or public services) (1).

Further, by exploring and analysing keywords from EUSAIR and each S3 document of the PILOT group within MRTPA Transport and Mobility it can be identified and noted those that fits best to prior listed most frequent scientific and policy objective subdomains (showed in **bold**):

**EUSAIR:** green sea mobility; green shipbuilding; clustering port activities; developing ports; developing motorways of the sea; development of air transport.

**FRIULI-VENEZIA GIULIA:** technologies and systems for the safety of maritime vessels, infrastructure and transport systems; methods and systems for predicting the behavior of the vessel in various operating conditions, even if extreme; integrated on-board and sea-land navigation systems, port operations, management of offshore vessels.
**BASILICATA**: sustainable mobility; **electric mobility**; **electrochemical storage systems**; **battery management system**; innovative technologies for high efficiency propulsion systems and for hybrid vehicle engine applications.

**CENTRAL MACEDONIA**: smart, sustainable and intermodal transport.

**SLOVENIA**: internal combustion engines; **e-mobility and energy storage systems**; systems and components for security and comfort; materials for the automotive.

**CROATIA**: new technologies and equipment related to reducing CO$_2$; new materials; automotive engineering services; **green vessels and greener combustion-based ship propulsion**, **robotic automation and drive technology**, electro propulsion, auxiliary power supplies technologies related to electro-mobility, safer waterborne transport and maritime operations; smart and secure mobility and logistics; cooperative systems and intelligent urban mobility; technologies and use of autonomous unmanned vehicles for monitoring of the environment.

**SERBIA**: information and communications technologies

**ALBANIA**: information and communications technologies

### 12.5 Foresight area proposal

**Green coastal & maritime mobility**

Proposed area is focused on “green” technology and solutions in relation to maritime mobility of people and freight to boost economic regional development in respect to environmental issues and nature preservation of Adriatic-Ionian sea basin.

Based on proposed macro regional trajectory and described trends within EUSAIR Transport and mobility pillar (besides large regional interconnecting infrastructural projects), foresight area should be based on few of “more SME based” solutions and skills for green costal and maritime mobility. Foresight areas subtopics might include:

1. Hybrid propulsions and vessel energy efficiency systems
2. Coastal (short-sea) based Intelligent transport systems (ITS)
3. Smart ports solutions.

**Hybrid propulsions and energy efficiency systems** – development of new hybrid/electrical energy efficient systems for vessels. Main focus is on development of hybrid or electrical motors, advanced energy storage technologies, battery management systems and advanced vessel energy micromanagement systems.

**Coastal (short-sea) based intelligent transport systems (ITS)** – maritime version of ITS solutions targeted at ICT upgrade of existing naval traffic management. It is based on real time maritime traffic data from sensors installed into vessels, data collection and Big data analysis in control traffic centers with interface to other transport modes especially to hinterland.

**Smart ports solutions** – upgraded and digitalized port operations, infrastructure and services in order to serve as important interface towards hinterland transport operations creating boost for transport and logistics activities. New port operations as an integration of various infrastructures, both physical
and IT. Digital solutions for efficient traffic management, which is made possible by interlinking the information and communication systems. Building physical infrastructures in order to support installation of hybrid/electrical propulsion and energy efficient systems into new or retrofitting to existing vessels.

<table>
<thead>
<tr>
<th>Rationale for selection of above mentioned development trajectory has stronghold in:</th>
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</thead>
<tbody>
<tr>
<td>a) Prior development documents of the macro-region (notably EUSAIR strategy).</td>
</tr>
<tr>
<td>b) Smart Specialisation Strategies of regions and countries included in devising pilot MRS3.</td>
</tr>
<tr>
<td>c) Indicators supporting specialisation of Adriatic-Ionian macro-region in transport and mobility sector.</td>
</tr>
</tbody>
</table>
| d) Transport and mobility related scenarios from Glimpses of the future from the BOHEMIA study.  

<table>
<thead>
<tr>
<th>12.6 R&amp;D topics</th>
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| Horizon Europe R&D foresight – BOHEMIA study is the main EU strategic foresight study in support of the Commission’s proposal for Horizon Europe – the EU framework programme for research and innovation 2021-2027.  

Important R&D topics can be associated with foresighted R&D topics from BOHEMIA study:

1. research on batteries;
2. research on hydrogen fuel cells;
3. ecologically efficient materials;
4. understanding and improving quality control in industries which may become reliant on 3D printing;
5. requirements for developing solutions with an environmental, social and economic impact assessment;
6. design solutions for sustainable mobility of people and goods;
7. research on battery efficiency, energy storage and recovery technologies;
8. testing new mobility service solutions in pilot areas;
9. research to reduce digital exposure to critical infrastructure;
10. developing better algorithms for machine learning;
11. ICT solutions for autonomous systems, including systems developed in remote and extreme environments;
12. privacy and privacy protection;  

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13. requirements for developing solutions with an environmental, social and economical impact assessment;
14. design solutions for sustainable mobility of people and goods;
15. testing new mobility service solutions in pilot areas;
16. research and development of new traffic control systems;
17. multilateral Transport Systems Interoperability Standards Agreements;
18. rules for autonomous transport of roads and waterways;
19. research on human-automated vehicles interfaces;
20. research on smart grid management and on the opportunities for cross-domain solutions (Smart Mobility, Smart City and Smart Grids);
21. regulation of data security and liability in the context of automated transport;
22. investigation of the mobility needs in relation with personal freedom.

Several important R&D topics can be associated in addition to foresighted R&D topics from BOHEMIA study:

1. green vessels and greener combustion-based ship propulsion;
2. advanced maritime structures and lightweight materials;
3. robotic automation and drive technology;
4. electro propulsion, auxiliary power supplies technologies related to electro-mobility;
5. safer waterborne transport and maritime operations (reduction of marine accidents consequences);
6. integrated power and heat systems;
7. innovative transport and logistics services;
8. cooperative systems;
9. equipment, systems and applications for traffic monitoring, management and control
10. incident management systems;
11. advanced embedded positioning and navigation.

12.7 Supporting technologies (KETs)

As regards future technologies, several foresight studies have indicated that the current set of KETs are still among the technologies that are most likely to disrupt economies and societies over the next 10-15 years. The OECD, based on several technology foresight exercises in its member countries and Russia, identified 40 key and emerging technologies that might best tackle the various ‘grand challenges’ the world faces (e.g. ageing, climate change, natural resource depletion, health inequality).\(^{138}\)

The most applicable key enabling technologies (KETs) that are proposed as most supportive ones for the Transport and Mobility foresighted area proposal are given in the following list.

\(^{138}\) OECD (2016), op. cit.
OPTION A – KETs (from Re-finding Industry)\textsuperscript{139}

I) PRODUCTION TECHNOLOGIES
   A) Advanced Manufacturing Technologies
      1) Process industry (processing of novel materials, structures, etc.)
      2) Robotics / Human machine interaction
      3) Monitoring and control
      4) High performance computing / cloud-based simulation services
      5) Intelligent/ sensor-based equipment
      6) Green propulsion technologies
   B) Advanced materials and Nanotechnologies
      1) High performance, smart sustainable materials
      2) Nanomaterials
      3) Nanotechnology
      4) Materials for energy storage and generation
      5) Lightweight technologies

II) DIGITAL TECHNOLOGIES
   A) Micro/Nano electronics and Photonics
      1) IoT
      2) Smart/Intelligent sensors
      3) Displays (LCD, plasma) and lightning (LED, OLED)
      4) Photonics integrated circuits and Biophotonics
   B) Artificial intelligence
      1) Data generation and handling,
      2) Big data analytics,
      3) Machine learning and deep learning
      4) Software technologies
      5) Decision making technologies

III) CYBER TECHNOLOGIES
   A) Security
      1) Secure and authenticated communication
      2) Avoiding identity thief
      3) Data protection and privacy
      4) IoT cyber security solutions
      5) Data/connectivity safety and security
      6) Human-machine-interfaces (HMI)
      7) 5G
   B) Connectivity
      1) Cyber Physical Systems
      2) Technology assessment
      3) Blockchain

\textsuperscript{139} European Commission, Directorate-General for Research and Innovation (2018), op. cit.
**OPTION B – KETs (OECD)**

A) **DIGITAL**
1) Cloud computing
2) Photonics and light technologies
3) Modelling simulation and gaming
4) Artificial Intelligence (AI)
5) Big data analytics
6) IoT
7) Robotics

B) **ENERGY + ENVIRONMENT**
1) Power micromanagement
2) Hydrogen energy
3) Autonomous vehicles
4) Electric vehicles (vessels)
5) Electric vehicles
6) Advanced energy storage tech

C) **ADVANCED MATERIALS**
1) Nanomaterials
2) Functional materials
3) Additive manufacturing

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140 OECD (2016), op. cit.
13. MRTPA Tourism and Culture

As a cradle of one of the world’s most important ancient civilizations (Roman and Greek) and its impact on the region and beyond, significance of AIR as tourism and culture destination is inevitable regarding its natural and cultural heritage. In the AIR, tourism accounts around 10 % of GDP and 66 % of foreign contribution of tourism to GDP.\textsuperscript{141} Tourism has a significant socio-economic impact on the EU economy, contributes 5 % of the EU GDP (direct contribution) and 5.2 % of the total labour force (12 million jobs) as one of the main entry point to the labour market (20 % of the employees aged below 25).\textsuperscript{142} In 2014, tourism with related sectors contributed by nearly EUR 1.6 trillion to the economy, which makes up 9.3 % of the total European DGP.\textsuperscript{143}

Sustainable and inclusive growth has become one of the main priorities and challenges when it comes to further development of products and services in the tourism and culture sector. Tourism, as one of the most prosperous sectors, has multiple spillover effect on a various sectors such as health, transport and mobility or agriculture. In 2015, countries adopted 2030 Agenda and its 17 Sustainable Development Goals (SDG) at UN Summit – tourism has been recognized as a link between all SDGs.

Following three SDGs include tourism as the target:\textsuperscript{144}

1. **Goal 8 Decent Work and Economic Growth**, target 8.9: “By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products”.

2. **Goal 12 Responsible Consumption and Production**, target 12.B: “Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products”.

3. **Goal 14 Life Below Water**, target 14.7: “By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism”.

According to the European Commission statistic data, Europe has positioned itself as the number one tourist destination in the world, both for leisure and business. In order to maintain this position, it is highly needed to anticipate upcoming trends, especially related to digitalization and commercialization of products and services on the EU level. Recently, culture and creative industries and its significance for the human society are being acknowledged, as they deserve. As growth boosting and job creation through innovation and research activities become one of the most important European Commission goals, slowly but significantly culture and creative industries start to play important role in addressing and overcoming many challenges on local and national level but also on the EU level as a single market. Culture, as sector that includes cultural and creative industries, tangible and intangible heritage,\textsuperscript{145} contributes tremendously in process of achieving prosperity of sustainable development across its three pillars – economic, environmental and social.


\textsuperscript{143} Ibid.


13.1 Global Industry overview

Tourism has become one of the world’s fastest growing industries that enables job creation and implementation of new technologies that boosts local and global competitiveness of its participants in accordance with implementation of sustainable growth and development policy. Tourism contributes 10 % of world’s GDP, 7 % of global trade and one in ten jobs.\textsuperscript{146} Tourism, as cross-cutting sector and the third largest economic activity in the EU (after Distribution and Construction) and mainly dominated by SMEs (3.4 million)\textsuperscript{147}, has been significantly affected by emerging and existing digital disruption and global trends in the field of technologies such as Big data, AI or IoT. Fostering collaboration between public sector, private sector (especially, SMEs and start-ups) and academia in joint projects for technology and knowledge transfer and exchange of good practices among EU countries and within them, accelerates and increases competitiveness and commercialization of products and services on domestic and international market.

In 2015, one in ten enterprises in the European non-financial business economy belonged to the tourism industries, employing 12.7 million persons.\textsuperscript{148} Europe was the most frequently visited region in the world in 2017, accounting for just over half (51 %) of the 1.32 billion international tourist arrivals.\textsuperscript{149}

According to the European Commission the main challenges for European tourism are:\textsuperscript{150}

1. \textit{security and safety} – includes environmental, political and social security; safety of food and accommodation; socio-cultural sustainability threats;
2. \textit{economic competitiveness} – seasonality, regulatory and administrative burdens; tourism related taxation; difficulty of finding and keeping skilled staff;
3. \textit{technological} – keeping up to date with IT developments caused by the globalization of information and advances in technology (IT tools for booking holidays, social media providing advice on tourism services, etc.);
4. \textit{markets and competition} – growing demand for customized experiences, new products, growing competition from other EU destinations.

In order to encourage positive changes in tourism community and to be prepared for inevitable upcoming transformation, four priorities for action were identified:\textsuperscript{151}

1. to stimulate competitiveness in the European tourism sector;
2. to promote the development of sustainable, responsible, and high-quality tourism;
3. to consolidate Europe’s image as a collection of sustainable, high-quality destinations;
4. to maximize the potential of EU financial policies for developing tourism.

Culture has become unquestionable and crucial factor in development transformation via implementation of the 2030 Agenda for Sustainable Development, its goals and targets – UNESCO as the only UN agency with the mandate in the culture area, actively contributes in addressing importance of culture in the 2030 Agenda implementation. On the EU level, culture and creative industries have

\textsuperscript{147} Lelonek Hustings I. (2016), op. cit.
\textsuperscript{151} Ibid.
been recognized as a fountain of dynamic society transition process on local, regional and global level, and source of diversity of values, culture, heritage and identity that boost creative and innovative approaches for smart and sustainable growth. Cultural and creative industries are important catalyst of changes that increase economic activities by capitalizing USD 2,250 billion and creating 29.5 million jobs globally in 2013.\textsuperscript{152} In 2012, cultural and creative sector generated around EUR 535.9 billion and 4.2 % of total GDP in the EU and was the third largest employer – more than 7 million people are directly or indirectly employed (around 3.3 % of total employment in the EU).\textsuperscript{153} It is crucial to mention that this sector has the highest rate of youth employment (age from 15 to 30 years) among all other sectors in the economy.

One of the main challenges that culture faces are:

1. access to finance
2. society awareness of importance of culture and creative industries and its high potential contribution as driver of job creation and growth
3. international cooperation deficiency
4. development policy implementation on local, national, regional and EU level
5. industry fragmentation
6. skills development.

\subsection*{13.2 Megatrends}

Tourism and Culture MRTPA faces with the most challenging transformation in its history mostly caused by the globalisation and upcoming digital revolution. Its ability to foresight and to adapt to upcoming social, environmental, technological and economic changes, ability to be proactively involved in the development of innovative products and services with optimal response to people’s requests and needs (conscious and unconscious form their perspective), along with its cross-cutting characteristics results with the prosperity, higher value-added and increase of the competitive and absolute advantages on the local and global market.

The following list represents the main megatrends with the significant effect on the Tourism and Culture MRTPA:

1. \textbf{Climate changes} – rising sea levels, fast disappearing ice sheets, extreme rainfalls, earthquakes, frequent heatwaves and other natural disasters leave significant effects on tourism destinations especially those whose economy mostly depends on its activities, but also on planning of future location and tourist arrivals. Climate changes affects destination competitiveness, but tourism also contributes to global warming, approximately 5 % of CO$_2$ emission globally.\textsuperscript{154} All above mentioned are the reason why tourism and culture should become the ambassadors of implementation of carbon neutral policy.

2. \textbf{Demographic changes} – increase of \textit{senior} tourists arrivals will determinate growth of specific and personalised services, such as health tourism solutions. Emerging \textit{middle class}, especially form the Asia, BRIC countries (Brazil, Russia, India and China) and the Middle East, growing trend of bleisure (combination of business and leisure tourism) and \textit{youth} (the Generation Y and Z as an influencers use and request for implementation of emerging

technologies in the process of planning and consuming tourism and culture services) must be the focal point of this pillar foresight.

3. **Technology** – digital channels development, social media, digitalisation, AI (such as personal assistants or predictive text), virtual reality, biometrics or gaming industry are one of the examples that will transform tourism and culture foundations.

4. **Experience** – how we think and how we consume tourism and culture products and services, especially regarding travel as a service, will remarkably change consumer’s expectations and experience.

5. **Sustainable community development** – it has shown that the basis for sustainable development of innovative products and services lies on strengths of local levels (its society and economy) and its social and cultural diversity and inclusivity as one of the main pillars of EU existence.

6. **Security** – recently civil unrest, terrorism and other security risks play important role in the process of planning and development of culture and tourism strategy.

13.3 AIR context

AIR region and its EUSAIR strategy include Tourism and Culture area into its two pillars through regional needs and indicative actions. Related EUSAIR areas per pillar are as follows:

1. **ENVIRONMENTAL QUALITY**
   - The marine environment
   - Transnational terrestrial habitats and biodiversity

2. **SUSTAINABLE TOURISM**
   - Diversified tourism offer (products and services)
   - Sustainable and responsible tourism management (innovation and quality)

Activities of the following pillars underpin the tourism and culture sector efforts in achieving smart, sustainable and inclusive growth:

1. **BLUE GROWTH**
   - Blue technologies
   - Fisheries and aquaculture

2. **CONNECTING THE REGION**
   - Maritime transport
   - Intermodal connections to the hinterland
   - Energy networks

Fisheries and aquaculture – over the last decades, Mediterranean diet has been recognized as one of the world’s healthiest diets that are based on the consumption of fresh and local food, especially seafood. Most of the tourist experience destinations with all five senses: sight, smell, hearing, touch and taste. Sustainable exploitation fisheries and aquaculture models enables availability of healthy and fresh seafood (food culture) as strong linkage to intangible cultural heritage.

The marine environment and Transnational terrestrial habitats and biodiversity – marine and terrestrial biodiversity and habitat preservation are one of the main factors influencing the tourists travel decision to a specific destination. Recently, intensified tourism and related culture activities, climate change, maritime and road transport make a lot of pressure on destination as source of biodiversity. In order to reduce this negative impact, implementation of ICT should be the initiator in addressing and actively solving some of the problems that endanger its existence, such as personalization of tourist experience (before, during and after) through tailor-made products and services, appeal to visitors behaviour while consuming diving, outdoor or nautical activities, harmonizing tourists requirements with local tourism offer (sustainable usage of resources) or on-line ticket reservation that prevents overcrowding environmental degradation in national parks.
Diversified tourism offer (products and services) – in order to provide value for money and experience of the lifetime to visitors (e.g. senior or millennials), AIR countries must base its offer on unique, high value-added, locally produced and provided, personalized, technology and creative industries supported products and services that contributes to reduction of ecological footprint. These efforts must be supported by the brand strategy on local, national and regional level.

Sustainable and responsible tourism management (innovation and quality) – although tourism represents important generator of income, economic growth and job creation, its underperformance in innovation application and sustainable management is manifestly and continues to undermine growth potential. Strategic tourism management that include finance, marketing activities, human resources and quality management must be aligned with sustainable policy and supported by all participants from private sector, public sector and academia as bearers of change. Culture and creative industries play important role in this transition, representing link between producers, consumers and places by utilising skills, technology and knowledge that generates intangible cultural products, creative content and experiences.\(^{155}\)

### 13.4 Eye@RIS3 tool analytics summary

For the purpose of getting better comparison of RIS3 priorities of the whole AIR region and for the PILOT group, Eye@RIS3 tool is used to find commonalities within those NUTS 2 regions having transport and mobility as one of its S3 priority domains. Analysis were conducted through three categorized domains:

A. **"Economic Domains"** categories are based on the Eurostat's NACE Rev. 2 sectoral codes and OECD categories.

B. **"Scientific Domains"** categories are based on the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007).

C. **"EU Policy Objectives"** includes ten EU-wide policy areas corresponding to the 'Societal Grand Challenges' identified in H2020 and the headline policies in the Innovation Union Flagship Initiative, including Creative and Cultural Industries, KETs, Social Innovation and the Digital Agenda.

Regarding **Regional RIS3 data**, most frequent subdomains of S3 or other strategic documents given by authorities are (frequency is noted in parentheses at the end of subdomains names):

A. **Economic subdomains:**
   1. I.55 Accommodation (21)
   2. I.56 Food and beverage service activities (21)
   3. R.90 Creative, arts and entertainment activities (21)
   4. N.79 Travel agency, tour operator and other reservation service and related activities (16)
   5. R.91 Libraries, archives, museums and other cultural activities (15).

B. **Scientific subdomains:**
   1. 10.87 Recreational and sporting services (28)
   2. 10.85 Cultural services (27)
   3. 10.86 Racial, cultural and social integration, sociology of science, religion, art, sport and leisure; media, language, libraries, archives and cultural policy (19)
   4. 10.84 Broadcasting and publishing services (3)
   5. 10.88 Religious and other community services (3).

C. **Policy Objective subdomains:**

Regarding **PILOT group RIS3 data**, most frequent subdomains of S3 or other strategic documents given by authorities are (frequency is noted in parentheses at the end of subdomains names):

### A. Economic subdomains:
1. C.16 Development of regional cultural & creative industries (23)
2. C.17 Support to link cultural & creative industries with traditional industries (17)
3. D.33 New media & easier access to cultural contents (e.g. heritage) (9)
4. F.44 Ecotourism (9)
5. J.70 Sustainable production & consumption (6).

### B. Scientific subdomains:
1. 10.87 Recreational and sporting services (7)
2. 10.85 Cultural services (4)
3. 10.86 Racial, cultural and social integration, sociology of science, religion, art, sport and leisure; media, language, libraries, archives and cultural policy (1)
4. 10.84 Broadcasting and publishing services (1)
5. 04.28 Transport systems (1).

### C. Policy Objective subdomains:
1. C.16 Development of regional cultural & creative industries (2)
2. C.17 Support to link cultural & creative industries with traditional industries (2)
3. D.33 New media & easier access to cultural contents (e.g. heritage) (2)
4. D.19 Artificial intelligence, cognitive systems, augmented and virtual reality, visualisation, simulation, gamification & interaction technologies (1)
5. F.44 Ecotourism (1).

Further, by exploring and analysing keywords from EUSAIR and each S3 document of the PILOT group within MRTPA Tourism and Culture it can be identified and noted those that fits best to prior listed most frequent scientific and policy objective subdomains (showed in **bold**):

**EUSAIR**: brand building of tourist products/services; improve quality of sustainable tourist offer; sustainable tourism R&D platform on new products and services; diversification of the cruise and nautical sectors and enhancement of the yachting sector; **sustainable and thematic tourist routes**; fostering cultural heritage; improving accessibility for tourism products and services; **upgrade tourism products**; network of Sustainable Tourism businesses and clusters; facilitating access to finance for new innovative tourism start-ups; promoting the Region in world markets; **expanding the tourist season to all year-round**; training in vocational and entrepreneurial skills in tourism; cooperation for facilitating tourist circulation; action for more sustainable and responsible tourism

**FRIULI-VENEZIA GIULIA**: technologies for the conservation and enhancement of goods and products; **geomatics and image processing; social platforms and sharing**

**BASILICATA**: open innovation for cultural heritage and creative industries; promote research applied to cultural heritage and widen the users' basin of creative and cultural technologies; promote social innovation projects and local handicraft industry; **creative industries for tourism; creative industries and design**; creative industries at the service of production sector; emergence of new models of social innovation and self-entrepreneurship linked to tourism and the use of cultural heritage; **ICT technologies for the acquisition, use, recovery, cataloguing, dissemination and sharing of tangible...**
and intangible cultural assets and of environmental goods; GIS technologies – cloud for integrated management, sharing and communication of cultural heritage on a geographical basis

CENTRAL MACEDONIA: environmental protection and sustainable development; coordination of agencies and businesses on Marketing issues (New Content, Destination Management Systems (DMS) and the corresponding institutional structure (DMO), social media, branding etc.); strengthening collaborative innovation and interconnection with other sector areas of regional interest, (Culture, Health, Sports, Food and agriculture, local crafts, Transportation, Education, Retail, design services, etc.); tourism innovation and inter-linkages with other productive sectors (bio-agro-food, ICT, etc.); eco-innovation (green ICT and tourism) sectors; diversify tourism offer towards higher-value added and 365 days a year attractions

SLOVENIA: sustainable and competitive tourism products; green, active and healthy tourist destination; integrated services providing a top-level experience by including and taking into account the preservation of nature and natural and cultural resources; customized and innovative tourism products and services; IT-based marketing and networking through the creation of innovative, integrated and sustainable tourism products and services; eco-tourism; visibility in terms of well-preserved nature, cultural heritage and offer, gastronomy and other traditional activities and the extraordinary achievements of individuals (e.g. in sports, culture); financial mechanism for culture and creative industries.

CROATIA: natural health products; new materials; smart grids and smart cities and complex energy systems; energy saving technologies

SERBIA: information and communication technologies; environmental protection & countering climate change

ALBANIA: ICT; biodiversity & environment; social sciences & Albanalogy

13.5 Foresight area proposal

Smart and creative upgrade of cultural tourism

As one of the four pillars of ADRION Programme, Sustainable region (including Conserving, protecting, promoting and developing natural and cultural heritage; Protecting and restoring biodiversity and soil and promoting ecosystem services, including through Natura 2000, and green infrastructure) recognized importance of tourism and culture activities as drivers of innovation, job creation and smart growth. Taking into consideration arguments previously mentioned and the fact that tourism and culture are highly competitive and interconnected sectors, Smart and creative upgrade of cultural tourism as holistic approach, which comprises tourism, culture, creative industries and ICT, simultaneously nurtures local community life quality, private sector business activities and tourists’ expectations. Over the last few decades, tourists’ expectations have significantly changed and new forms of off-site and on-site destination experience occurred, causing development of new types of cultural heritage job (e.g. heritage protection, enhancement and restoration based on ICT and creative industries tools).

Used as a cultural heritage fundamental tool, ICT accelerates implementation of sustainable policy and enhances tourism participants’ engagement and awareness, service delivery cost reduction or uses destination brand digital transformation as a tool for building deeper and personalized relationship with tourist that triggers emotional benefits of tailored-made experience. ICT empower unique sustainable tourism experience of the past in the present.
Based on proposed macro regional trajectory and described trends within EUSAIR Sustainable Tourism pillar, foresight area should be focused on few of “more SME based” solutions and skills for Smart and creative upgrade of cultural tourism. Foresight areas (subtopics) might include as follows:

1. Culture destination management (cultural heritage management)
2. Creative industries
3. Digital transformation.

**Culture destination management (cultural heritage management)** – cultural diversity has a strong effect on tourism and local economy and its stakeholder’s prosperity. AIR represents one of the attractive and richest region in Europe and beyond, accounting around 70 UNESCO heritage sites.\(^\text{156}\) Cultural tourism accounts for 40 % of all European tourism and 4 out of 10 tourists choose their destination based on its cultural offering.\(^\text{157}\) Globally, cultural tourism accounts 40 % of international arrivals.\(^\text{158}\) As one of the most important link in smart sustainable tourism, it is necessary to find balance between cultural heritage preservation and sustainable development of tourism sector. Cultural heritage management reduces seasonality and negative impact of tourism activities, boosts knowledge transfer, skills and competences development and quadruple helix collaboration and its coordination on domestic and AIR level. For example, Cultural Routes, as cultural diplomacy of the AIR region represented by tangible and intangible destination heritage, enable tourists and local population to experience past in the present on the sustainable, native and smart way.\(^\text{159}\)

**Creative industries** – creative industries\(^\text{160}\) have become leaders in enabling creative environment for the economy generally and represent a dynamic and highly perspective cross-border tool for cultural heritage revival. According to the identified and anticipated demand, it enables integration of disruptive business models, knowledge and experience transfer between regions in tourism that incorporate ICT based high value-added products and services. Creative industries, as a junction point of culture, tourism, ICT and other industries, enables new job and industry creation and accelerates consumption in targeted sectors. Taking into consideration that the Region has to compete with other emerging markets especially from Asia, and needs to keep up with challenges and trends such as providing personalized experience, new business models implementation enables sustainability and competitiveness of the tourism and economy as itself. Regarding a specific target group, different types of promotional tools are created (e.g. presence of cultural heritage in the video games as a promotion and branding tool for young generation identified as a target group).

**Digital transformation** – over the past two decades, digital transformation has affected all areas of economy and society, changed consumers habits and expectations. In order to respond to the increasing demand regarding visitors demography structure (e.g. millennials visit several tourism service providers before making the final decision where to travel and increasing importance of social media) and their specific requests and aspiration to travel, intensified digitalization in both tourism and culture become inevitable and its essential constituent. Technologies such as artificial intelligence (AI), Internet of Things (IoT), Big Data, software as a service (SaaS), mobile technology, augmented

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\(^{159}\) Council of Europe (2018), *Roadmap for the Adriatic-Ionian Region: Heritage protection, cultural tourism and transnational cooperation through the Cultural Routes*, https://rm.coe.int/16808ecc0a, retrieved: 25.1.2019


Creative industries definition includes spectrum of products and services such as traditional cultural expressions, cultural sites, visual arts, performing arts, publishing and printed media, audiovisuals, functional creations, design, creative services and new media.
OIS-AIR Pilot of Adriatic-Ionian MRS3

reality (AR), virtual assistants and blockchain are likely to have the most influence on tourism and culture transformation. ICT should enable virtual reality (VR) cultural heritage sites experience in the comfort of one’s home or at cultural heritage site (panoramic photography, VR time travel experience, sound simulation etc.).

Rationale for selection of above mentioned development trajectory has stronghold in:

a) Prior development documents of the macro-region (notably EUSAIR strategy).
b) Smart Specialisation Strategies of regions and countries included in devising pilot MRS3.
c) Indicators supporting specialisation of Adriatic-Ionian macro-region in tourism and culture sector.
d) Tourism and Culture related scenarios from Glimpses of the future from the BOHEMIA study.\textsuperscript{161}
e) \textit{Re-finding Industry – Defining Innovation}, Report from the High-Level Strategy Group on Industrial Technologies.\textsuperscript{162}

13.6 R&D topics

Horizon Europe R&D foresight – BOHEMIA study is the main EU strategic foresight study in support of the Commission’s proposal for Horizon Europe – the EU framework programme for research and innovation 2021-2027.\textsuperscript{163}

Important R&D topics can be associated with foresighted R&D topics from BOHEMIA study:

1. incentive schemes to promote products and services with minimum environmental footprint;
2. developing standards and codes of behaviour concerning the use of individuals' emotions for commercial and public purposes, as well as for emotional data sharing and privacy;
3. deeper understanding the role of emotion in human behaviour, with respect to both individual affects and group emotions;
4. studying the sharing of emotions for community-based initiatives (‘participatory sensing’);
5. exploitation of new business models for circular economy and promotion of sustainable lifestyles;
6. building models for a sustainable circular economy based on renewable resources and renewable energy;
7. developing educational solutions to balance individual needs and the consumption/production of goods;
8. research on smart grid management and on the opportunities for cross-domain solutions (Smart Mobility, Smart City and Smart Grids);
9. adapting educational techniques to online environments, and piloting various solutions (e.g. distributed online courses with tutoring, navigating through the stock of knowledge).

Several important R&D topics can be associated in addition to foresighted R&D topics from BOHEMIA study:

1. natural health products;

\textsuperscript{162} European Commission, Directorate-General for Research and Innovation (2018), op. cit.


OIS-AIR is implemented through the financial support of the ADRION programme

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2. personalized health products and services;
3. sustainable tourism underpinned by emerging technologies (AI, IoT, SaaS, AR, mobile technology, blockchain etc.).

13.7 Supporting technologies (KETs)

As regards future technologies, several foresight studies have indicated that the current set of KETs are still among the technologies that are most likely to disrupt economies and societies over the next 10-15 years. The OECD, based on several technology foresight exercises in its member countries and Russia, identified 40 key and emerging technologies that might best tackle the various ‘grand challenges’ the world faces (such as ageing, climate change, natural resource depletion, health inequality).\textsuperscript{164}

The most applicable key enabling technologies (KETs) that are proposed as most supportive ones for the Tourism and Culture foresighted area proposal are given in the following list.

\textbf{OPTION A – KETs (from Re-finding Industry)\textsuperscript{165}}

\begin{itemize}
  \item[I)] DIGITAL TECHNOLOGIES
    \begin{itemize}
      \item[A)] Micro/Nano electronics and Photonics
        \begin{itemize}
          \item[1)] IoT
        \end{itemize}
      \item[B)] Artificial intelligence
        \begin{itemize}
          \item[1)] Data generation and handling,
          \item[2)] Big data analytics,
          \item[3)] Machine learning and deep learning
          \item[4)] Virtual agents
          \item[5)] Software technologies
          \item[6)] Decision making technologies
        \end{itemize}
    \end{itemize}
  \item[II)] CYBER TECHNOLOGIES
    \begin{itemize}
      \item[A)] Security
        \begin{itemize}
          \item[1)] IoT cyber security solutions
          \item[2)] Data/connectivity safety and security
          \item[3)] HMI Human-machine-interfaces
          \item[4)] Human computer/robot interaction
        \end{itemize}
      \item[B)] Connectivity
        \begin{itemize}
          \item[1)] Blockchain.
        \end{itemize}
    \end{itemize}
\end{itemize}

\textbf{OPTION B – KETs (OECD)\textsuperscript{166}}

\begin{itemize}
  \item[A)] DIGITAL
    \begin{itemize}
      \item[1.) Internet of Things (IoT)
      \item[2.) Big data analytics
      \item[3.) Artificial intelligence (AI)
      \item[4.) Blockchain
      \item[5.) Modelling simulation and gaming
      \item[6.) Quantum computing
      \item[7.) Cloud computing
    \end{itemize}
\end{itemize}

\textsuperscript{164} OECD (2016), op. cit.
\textsuperscript{165} European Commission, Directorate-General for Research and Innovation (2018), op. cit.
\textsuperscript{166} OECD (2016), op. cit.
B) BIOTECHNOLOGIES
   1. Personalised medicine
C) ADVANCED MATERIALS
   1. Additive manufacturing.
14. MRTPA Health and Medicine

The lack of health promotion and disease prevention, the rise of non-communicable diseases, and the persistence of health inequalities are at the top of the list of the major health challenges facing the EU. These complex challenges are interlinked and require multidisciplinary, cross-sectoral and transnational collaborations.

In the same time, the large share of healthcare costs in the EU, raises the issue of cost-effectiveness and the financial sustainability of health systems. Industry growth, major changes, and strong value-creation potential make healthcare an exciting industry. Substantial upside exists for players that can deliver value-creating solutions. A company in a healthcare market should: \(^{167}\)

1. innovate to create value for the stakeholders who consume and pay for healthcare;
2. understand the evolution of the industry’s profit by increasing productivity to lower costs, improving healthcare delivery and healthcare outcomes, or offering better consumer engagement;
3. investment in the creation of new clinical pathways that improve care delivery and outcomes, new business models with significantly lower costs, and a reorientation from delivery-centric models to consumer-centric ones should receive priority over traditional approaches. Partnerships will be important to align with the sources of value creation.

Health and social challenges should be seen in ways that subsequently boost productivity and competitiveness. It is important to ensure that technologies support, the development of health systems. Digital technologies offer new opportunities to transform health systems, including new approaches to personalized prevention and promotion, treatments and care, accelerated scientific progress for early diagnosis, and prevention of diseases. \(^{168}\)

14.1 Global industry overview

Health systems contribute to preserving and restoring good health of the EU population. \(^{169}\) Fee for service is the health system, which is running in many countries, and it is volume-based, fragmented, costly and not efficient system. European health systems have faced growing common challenges: increasing cost of healthcare, population ageing associated with a rise of chronic diseases and multi-


The definition of health system according to the WHO is that “Health systems are responsible for delivering services that improve, maintain or restore the health of individuals and their communities. This includes the care provided by hospitals and family doctors, but also less visible tasks such as the prevention and control of communicable disease, health promotion, health workforce planning and improving the social, economic or environmental conditions in which people live.”
morbidity leading to growing demand for healthcare, shortages and uneven distribution of health professionals, health inequalities and inequities in access to healthcare. An answer to those challenges is sustainable new healthcare systems with adequate funding, investments, and innovation to support them.\textsuperscript{170}

Two significant factors in creating more sustainable health system are:\textsuperscript{171}

1. delivering value to consumers;
2. developing a broader, more holistic, consumer-centered approach that focuses on wellness and prevention, and on continuous management of health.

This new model of health crosses sectors and encompasses economic, social, and other aspects of individuals’ lives. Delivering value as the consumer defines it becomes the ultimate goal of healthcare systems. Value is determined by factors such as the quality of the customers’/patients’ experience, how treatment affects their lifestyle, and how much consumers receive for their healthcare money. This new system is outcome based healthcare system (or value-based care) which measures outcomes of treating processes according to defined indicators combining with patient experience. This model is cost-effective and patient centric with multidisciplinary approach in treatment. Transition from one model to another, from volume to value, require building an outcomes-based financial model and data infrastructure to maximize value-based care reimbursement pathways.

The healthcare market is looking to health technology for help. New technologies are an important tool for boosting innovations. It is imperative for stakeholders across the health care ecosystem to collaborate around a whole-life approach to funding and delivering sustainable health care. Investments in technology such as virtual health and telehealth & telemedicine are transforming the industry and enabling more self-care.\textsuperscript{172} One of the biggest technology-driven disruptions is the transition of care. Already, more than 50% of one world’s health insurer visits are virtual, leveraging smartphones, videoconferencing, and other technology, with many start-ups entering the arena.

Advances in genomics science and personalised medicine are leaders of transforming healthcare as well as improving care delivery systems with new methods of diagnostics. Genomics science is shifting the focus of the healthcare industry from illness to wellness. In the long term, genomics science could help to bend the cost curve by ensuring that the right person receives the right treatment at the right time. It will also be a big benefit to pharma industry.\textsuperscript{173}

Globally, pharma industries-manufactured pharmaceuticals, biopharmaceuticals, medical equipment and devices are worth approximately USD 1 trillion and are growing over time. Changes in

\textsuperscript{173} PWC (2017), op. cit.
pharmaceuticals industries globally showing new business models and product categories that allow companies to capture value and to compete on quality and product differentiation.

Since life expectancy continues to rise – number of people aged over 65 globally is more than 668 million, or 11.6 %, of the total global population the pressure to healthcare systems will also rise. Global health care expenditures are expected to continue to rise as spending is projected to increase at an annual rate of 5.4 % between 2017-2022, from USD 7.724 trillion to USD 10.059 trillion. The healthcare sector accounts for 10 % of the EU’s GDP Health technology sector, most developing sector, is expected to reach USD 280 billion by 2021, at a CAGR of 15.9 % between 2016–2021. The healthcare sector accounts for 8 % of the total European workforce. The Global Strategy on Human Resources for Health: Workforce 2030 reports that shortages can mount up to 9.9 million physicians, nurses and midwives globally by 2030.

14.2 Megatrends

Healthcare industry is affected by several global megatrends and common to all countries and regions particularly naming most important:

1. **Aging population.** With more people living longer, it is estimated that the number of people over 65 years of age will increase by 2050. This is putting enormous strain on healthcare system finances as the ratio of contributors to beneficiaries becomes imbalanced.

2. **Rising health care costs.** Health care (HC) spending has outstripped GDP and income growth in almost every country of the world. This trend places increasing pressures on healthcare systems that are already overburdened by aging populations and stagnant financing.

3. **Rise in chronic conditions and multi morbidity.** As people live longer, they typically face a number of chronic conditions such as hypertension, high cholesterol, rheumatoid arthritis, diabetes, heart disease, cancer, and so on.

4. **Health conscious consumers.** As information on health conditions has disseminated through multi-media, consumers have become more health conscious and informed. Consumers are increasingly taking an interest in managing their health for disease prevention.

5. **Use of data.** Big data is helping develop insights into population behaviour, health outcomes, and new methods of delivery. Most importantly, big data is contributing to advances in predictive diagnostics by analysing population characteristics, risks, preferences, and genetic makeup.

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174 Deloitte (2019), op. cit.
175 Ibid.
176 Ibid.
14.3 AIR context

Primary rationale for devising Health and Medicine as one of the MRTPAs of pilot MRS3 AIR is the fact that Health and Medicine is the fourth most frequent thematic priority area found in national/regional development documents (both S3s and other development documents).

Next to sheer prevalence of interest among nations and regions in aforementioned thematic area, second rationale for selecting Health and Medicine as macro regional thematic priority area, is the fact that health is one of societal challenges that H2020 Programme will try to meet through it funding schemes.

Moreover, looking into future, BOHEMIA project serves as “the main EU strategic foresight study in support of the Commission’s proposal for Horizon Europe - the EU framework programme for research and innovation 2021-2027.”

Therefore, support for inclusion of Health and Medicine in macro-regional S3 is founded within Bohemia foresight “Transitions on the Horizon: Perspectives for the European Union’s future research and innovation policies”. Out of 19 targeted scenarios of likely disruptive futures that are developed within BOHEMIA project, four, of those targeted scenarios, include themes that fall under broad umbrella of human health:

1. Assisted Living
2. Defeating Communicable Diseases
3. Human Organ Replacement
4. Precision Medicine.

Furthermore, Carlos Moedas, Commissioner for Research, Science and Innovation of European Commission states, in foreword to the document states that “study involves scenarios and recommendations that broaden our strategic intelligence and allow us to reflect on new important emerging areas, risks and opportunities, and on new ways to stimulate important transitions.”

This being stated, in our opinion, justifies the selection of Health and Medicine as a MRTPA of pilot MRS3 AIR.

14.4 Eye@RIS3 tool analytics summary

For the purpose of getting better comparison of RIS3 priorities of the whole AIR region and for the PILOT group, Eye@RIS3 tool is used to find commonalities within those NUTS 2 regions. Analysis are made through three categorized domains:

1. "Economic Domains" categories are based on the Eurostat's NACE Rev. 2 sectoral codes and OECD categories.

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2. "Scientific Domains" categories are based on the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007).

3. "EU Policy Objectives" includes ten EU-wide policy areas corresponding to the 'Societal Grand Challenges' identified in H2020 and the headline policies in the Innovation Union Flagship Initiative, including Creative and Cultural Industries, KETs, Social Innovation and the Digital Agenda.

Regarding **Regional RIS3 data**, most frequent subdomains of S3 or other strategic documents given by authorities are (frequencies are in brackets):

A. **Economic subdomains:**
   1. Q.86 Human health activities (16)
   2. C.21 Basic pharmaceutical products and pharmaceutical preparations (9)
   3. Q.87 Residential care activities (8)
   4. C26 Computer, electronic and optical products (6)
   5. M.72 Scientific research and development (6)

B. **Scientific subdomains:**
   1. 07.65 Health promotion (15)
   2. 10.87 Recreational and Sporting activities (13)
   3. 12.105 Medical Sciences (13)
   4. 07.66 Monitoring the health situation (12)
   5. 07.71 Public health services (12)

C. **Policy Objective subdomains:**
   1. G.49 Public health & well-being (16)
   2. D.27 e-Health (8)
   3. G.46 Ageing societies (8)
   4. E.39 Industrial biotechnology (6)
   5. G.48 Food security & safety (5)

Regarding **PILOT group RIS3 data**, most frequent subdomains of S3 or other strategic documents given by authorities are:

A. **Economic subdomains:**
   1. Q.86 Human health activities (4)
   2. C.21 Basic pharmaceutical products and pharmaceutical preparations (3)
   3. Q.87 Residential care activities (3)
   4. C.10 Food products (2)
   5. C.11 Beverages (2)

B. **Scientific subdomains:**
   1. 12.105 - Medical sciences (7)
   2. 07.65 - Health promotion (3)
   3. 07.67 - Occupational health (3)
   4. 07.71 - Public health services (3)
   5. 07.66 - Monitoring the health situation (2)
   6. 07.68 - Personal health care for vulnerable and high risk population (2)
7. 07.70 - Public health management (2)

C. Policy Objective subdomains:
   1. G.49 - Public health & well-being (3)
   2. E.39 - Industrial biotechnology (2)
   3. D.27 - e-Health (e.g. healthy ageing) (1)
   4. G.46 - Ageing societies (1)
   5. E.37 - Advanced manufacturing systems (1)
   6. E.38 - Advanced materials (1)

Further, by exploring and analysing keywords from each S3 document within MRTPA Health and Medicine it can be identified and noted those that fits best to prior listed most frequent scientific and policy objective subdomains (showed in bold):

EUSAIR: health is not part of EUSAIR.

BOSNIA AND HERZEGOVINA: medical and health sciences.

GREECE: health and pharmaceuticals; biomaterials; tissue engineering; diagnostic techniques; drug-delivery mechanisms; customized medication, biosensors, bioinformatics and nanomedical applications; telemedicine.

THESSALIA: emerging area: rehabilitation and advanced health services.

IPEIROS: health & well-being.

IONIA NISIA: ICTs; biology and medical services nexus; neurodiagnostics; bioinformatics; pharmaceutical and diagnostic applications.

FRIULI-VENEZIA GIULIA: smart health; biomedical, biotechnology, bioinformatics; medical informatics; management and maintenance of biomedical equipment, diagnostic imaging and biotechnology as well as the development and management of systems and solutions applied to medical informatics and bioinformatics; active promotion of home care, healthcare services at home; create integrated care procedures guaranteeing the continuity of care; improving the quality of life, healthcare & welfare; development of new technologies and services in smart & active aging area; innovative therapy; Ambient Assisted Living; technology platforms for human diagnostics and clinical evaluation of the patient; personalised and translational medicine; biomedical research; new diagnostic instruments; an integrated and holistic vision of care levels; personalized medicine; products and services related to telemedicine, telecare, home automation, nutraceutics, health aids, as well as other products and services for the prevention and the welfare of citizens.

ABRUZZO: advanced technologies for health and living care services (Life Science); cutting-edge (bio and nanomaterials) and industry 4.0 technologies for a more competitive health care system based on tailored services and products; effective prevention and a next-practice approach; advanced productive processes and integrated services for a lower environmental impact.

MOLISE: Life Sciences; activities associated to health and well-being, including e-health; Ambient Assisted Living; healthy ageing.

CALABRIA: healthy living care services and products (life sciences); new technologies and medical devices to improve patients care, diagnosis and treatment.
SICILIA: healthy living care services and products (Life Sciences); new technologies and medical devices to improve patients care, diagnosis and treatment; new diagnostic methods for chronic and complex diseases; new pharmaceutical formulations and products; regenerative medicine; diagnostics and biomedical; devices; drug discovery, delivery and quality by design; digital transformation for healthcare (e-health).

PROVINCIA AUTONOMA DI BOLZANO/BOZEN: healthy living care services and products (Life Sciences); new technologies and solutions to improve patients care, diagnosis and treatment; health and well-being, health tourism, e-health, natural and organic products (cosmetics, etc.)

MARCHE: Ambient Assisted Living and health industry; increasing provision of smart and high quality personal care products/services with focus on solutions and models for active longevity.

SLOVENIA: field of biopharmaceuticals; translational medicine: diagnostics and therapeutics; cancer treatment – diagnosis and therapy; resistant bacteria; natural medicines and cosmetics.

CROATIA: pharmaceuticals, biopharmaceuticals, medical equipment and devices; biotechnology and pharmaceuticals (together with ICT industry); dosage forms and active pharmaceutical ingredients; translational medicine, bone regeneration, neuroscience, immunology and microbiology, genetics and molecular biology and cancer research; optimization of existing health services and processes and development of new health services and new methods of preventive medicine and diagnostics; e-solutions for health, new technologies for remote health care delivery and improvement of the quality of life through the enhancement and extension of the scope of e-health and new opportunities for the integration of mobile health (m-health); “Big data” technology; Ambient Assisted Living

14.5 Foresight area proposal

Sustainable new healthcare models

Proposed area is focused on sustainable new health system in relation to give “answer” – start solving the biggest problem, the rising costs in healthcare industry and inefficiency of the present health care delivery model. Based on the importance of health in the economy of each country, proposed trajectory and described trends as well as foresight area should be SME based. Foresight areas subtopics might include:

Ultimately, successful transition of the private health sector to a more competitive position in the global health industry will require coordination of various actors. As the starting point firms should aim to use this new model of healthcare to generate endogenous growth in domestic private health markets.

1. Outcome-based healthcare model (Value-based care – VBC)
2. New technologies and Data Management
3. Personalised medicine
4. Health tourism

Outcome based healthcare model (Value-based care – VBC) – value-based healthcare is a healthcare delivery model in which providers, including hospitals and physicians, are paid based on patient health outcomes. Under value-based care agreements, providers are rewarded for helping patients improve their health, reduce the effects and incidence of chronic disease, and live healthier lives in an evidence-
based way. The “value” in value-based healthcare is derived from measuring health outcomes against the cost of delivering the outcomes.

\[ Value = \frac{Health\ Outcome}{Costs} \]

The benefits of a value-based healthcare system extend to patients, providers, payers, suppliers, and society as a whole. New healthcare delivery models mean a team-oriented approach to patient care.

**New technologies and Data Management** – digital technologies are supporting health systems' efforts to transition to new models of patient-centered care and helping them develop “smart health” approaches to increase access and affordability, improve quality, and lower costs. From Blockchain, cloud, artificial intelligence (AI), and robotics, to internet of medical things (IoMT), digital and virtual reality are just some of the ways technology is disrupting health care. Telehealth and digital medicine tools are enabling a “care anywhere” model. These technologies are helping with diagnosis and treatment, helping with speed, quality and accuracy, and improving the patient experience.\(^1\) The ability to (a) collect outcome and cost data for each patient, (b) aggregate and then analyse large panel data sets, and (c) commercialize those analytics, can create significant value for health systems.

**Personalised medicine** – better diagnoses, earlier interventions, more-efficient drug therapies, customized treatment plans. These are the promises of personalized medicine, also known as precision medicine or individualized medicine. Personalized medicine provides a genomic blueprint to determine each person's unique disease susceptibility, define preventive measures and enable targeted therapies to promote wellness.

Human genome research is the foundation for the future of personalized medicine, and has the ability to customize medical treatments to individual patients through the incorporation of genetics, molecular profiles and clinical characteristics in treatment determination.\(^2\)

**Health tourism** – health tourism is a subsector of general tourism that comprises medical, wellness, and spa tourism. Medical tourism involves people travelling expressly to access medical treatment. People travel for wellness tourism to maintain or enhance their personal health and well-being. Spa tourism focuses on healing, relaxation or beautifying of the body that is preventative and/or curative in nature. The three forms of health tourism (medical, wellness, and spa) reside on two parallel continuums: “illness-health-wellness” and “curative-preventative-promotive”.

Within the EU28, 56 million domestic and 5.1 million international trips in total were recorded for 2014. Health tourism's share of these trips is small at 4.3 % of all arrivals. Only 5.8 % of all domestic arrivals and only 1.1 % of all international arrivals are health tourism trips. Health tourism revenues total approximately EUR 47 billion, which represents 4.6 % of all tourism revenues and 0.33 % of the EU28 GDP. Medical tourism is a volatile market that is dependent on legislation and waiting lists in regular healthcare. National and regional health-tourism policies are quite common in the member states. These policies aim to improve or guarantee the quality of health tourism through supporting

\(^{1}\) Deloitte (2019), op. cit.

collaborations, promotional campaigns, regional specialisation, legislation, health tourism projects and by using health tourism to reduce tourism seasonality.\textsuperscript{183}

Rationale for selection of above mentioned development trajectory has stronghold in:

- a) Prior development documents of the macro-region (notably EUSAIR strategy).
- b) Smart Specialisation Strategies of regions and countries included in devising pilot MRS3.
- c) Indicators supporting specialisation of Adriatic-Ionian macro-region in health and medicine sector.
- d) Health and Medicine related scenarios from Glimpses of the future from the BOHEMIA study.\textsuperscript{184}
- e) \textit{Re-finding Industry – Defining Innovation}, Report from the High-Level Strategy Group on Industrial Technologies.\textsuperscript{185}

14.6 R&D topics

Horizon Europe R&D foresight – BOHEMIA study is the main EU strategic foresight study in support of the Commission’s proposal for Horizon Europe - the EU framework programme for research and innovation 2021-2027.\textsuperscript{186}

Important R&D topics can be associated with foresighted R&D topics from BOHEMIA study:

1. e-health solutions including telemedicine, measuring health data and transfer;
2. effective public health education about communicable diseases, incl. prevention, treatments, hygienic questions, disinfection;
3. making use of biotechnologies for personalized medicine;
4. personalised disease prevention for every-day life (including personalised diet and physical activity programmes);
5. international standards and quality assurance for precision medicine;
6. strong public health orientation: precision medicine for all, as part of the way ‘towards health for all’;
7. providing a healthy start to our next generation;


Recommendations: 1) Regarding medical tourism, include more spa treatments in national healthcare systems, remove upfront payment for cross-border healthcare and more effectively promote the uptake of Directive 2011/24/EU; 2) Health tourism improved data are necessary; 3) Continue funding for health-tourism projects. Also, there is scope for funding renovation and renewal projects of existing spas to better equip these for the national and international markets; 4) A policy scenario aiming at enhancing health in the EU through further developing and integrating health tourism and healthcare and using the opportunities for prevention rather than cure.


\textsuperscript{185} European Commission, Directorate-General for Research and Innovation (2018), op.cit.

8. safety and medical regulation, including risk assessment.

Several other important R&D topics can be associated in addition to foresighted R&D topics from BOHEMIA study:

1. human and animal drug discovery and drug development (new chemical and bio-tech entities);
2. new chemical synthesis processes for generic substances, product or new entities;
3. development of new medical technology and protocol/procedure;
4. development of medical (including dental) equipment and devices;
5. novel methods of preventive medicine;
6. novel diagnostic and therapeutic tools and applications;
7. clinical research; regenerative medicine and tissue engineering;
8. systems, applications and solutions for public health management and monitoring and improvement of quality of health services;
9. medical wellness multimodal programs and tools focused on the cornerstones of good health to create fresh, personalized wellness products and services;
10. equipment, systems, applications and solutions used in research and testing of new treatment and diagnostics methods and monitoring disease changes; applications and solutions with purpose of consulting, diagnostics, treatment and remote operations (telemedicine).

14.7 Supporting technologies (KETs)

As regards future technologies, several foresight studies have indicated that the current set of KETs are still among the technologies that are most likely to disrupt economies and societies over the next 10-15 years. The OECD, based on several technology foresight exercises in its member countries and Russia, identified 40 key and emerging technologies that might best tackle the various ‘grand challenges’ the world faces (such as ageing, climate change, natural resource depletion, health inequality).187

The most applicable key enabling technologies (KETs) that are proposed as most supportive ones for the Health and Medicine foresighted area proposal are given in the following list.

OPTION A – KETs (from Re-finding Industry)188

I) PRODUCTION TECHNOLOGIES
   A) Advanced Manufacturing Technologies
      1) Smart Manufacturing / Industry 4.0
      2) Robotics / Human machine interaction
      3) Process industry (processing of novel materials, structures, etc.)
      4) Monitoring and control
      5) High performance computing / cloud-based simulation services
      6) Additive manufacturing
      7) High-performance production (flexibility, productivity, precision and zero defect)

187 OECD (2016), op. cit.
188 European Commission, Directorate-General for Research and Innovation (2018), op. cit.
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8) High-performance, high precision processing
9) Intelligent/ sensor-based equipment

B) Advanced materials and Nanotechnologies
   1) High performance, smart sustainable materials
   2) Nanomaterials
   3) Nanotechnology
   4) Biomaterials
   5) New chemistry

C) Life science technologies
   1) Industrial biotechnology
   2) High throughput biology
   3) Automation for biology
   4) Synthetic biology
   5) Genomics (genome engineering/synthetic genomes)
   6) Cell and tissue engineering
   7) Biologization manufacturing
   8) Biosensors
   9) BioActivators
  10) BioActuators
  11) Lab on a Chip
  12) New chemistry
  13) Neural technologies

II) DIGITAL TECHNOLOGIES
   A) Micro/Nano electronics and Photonics
      1) IoT
      2) Smart/Intelligent sensors
      3) Quantum technology
      4) Supercomputing (high power, high performance, neurocomputing, beyond CMOS)
      5) Displays (LCD, plasma) and lightning (LED, OLED)
      6) Photonics integrated circuits and Biophotonics
   B) Artificial intelligence
      1) Data generation and handling,
      2) Big data analytics,
      3) Machine learning and deep learning
      4) Smart robots
      5) Virtual agents
      6) Software technologies
      7) Decision making technologies

III) CYBER TECHNOLOGIES
   A) Security
      1) Secure and authenticated communication
      2) Avoiding identity thief
      3) Data protection and privacy
      4) IoT cyber security solutions
      5) Data/connectivity safety and security
      6) HMI Human-machine-interfaces
      7) Human computer/robot interaction
      8) Baseband/ processor platforms
   B) Connectivity
      1) e-governance
2) e-administration
3) e-voting
4) Cyber Physical Systems
5) e-safety and e-Security
6) Technology assessment
7) Blockchain.

OPTION B – KETs (OECD)\textsuperscript{189}

A) DIGITAL
1) Internet of Things (IoT)
2) Big data analytics
3) Artificial intelligence (AI)
4) Blockchain
5) Modelling simulation and gaming
6) Quantum computing
7) Robotics
8) Cloud computing
9) Photonics and light technologies

B) BIOTECHNOLOGIES
1) Bioinformatics
2) Personalised medicine
3) Health monitoring technology
4) Medical bioimaging
5) Neurotechnologies
6) Biochips and biosensors
7) Stem cells
8) Regenerative medicine and tissue engineering
9) Biocatalysis
10) Synthetic biology

C) ADVANCED MATERIALS
1) Nanomaterials
2) Nanodevices
3) Additive manufacturing
4) Functional materials.

\textsuperscript{189} OECD (2016), op.cit.
15. Annex I Benchmark analysis along innovation chain (upstream, midstream and downstream)

Figure 54 Innovation value chain analysis

Source: Radosevic and Walendowski (2016), op. cit.

Methods and tools utilized in process of selection of Macro regional Thematic priority areas of MRS3 are as follows: 190

1. level of commonality of specialisations among analysed documents (S3 and innovation/economic development documents);
2. alignment with pillars and topics of EU Strategy for the Adriatic-Ionian region;
3. benchmarking of selected priority area along innovation chain as proposed in aforementioned document.

Whereas first two criteria are already explained in second chapter Methodology, in detail, third criteria needs elaboration to certain extent.

Firstly, benchmarking of selected macro-regional thematic priority areas was carried out on following data: 191

1. data from SCImago Country and Journal rank
2. data from participation in FP7 and H2020 projects
3. data from Eye@RIS3 tool
4. data on employment form Structural Business statistics on NUTS 2 level and by NACE Rev. 2 classification obtained from EUROSTAT
5. data on patents in KETs obtained from KETS Observatory.

---

191 Due to limited availability of data on NUTS 2 level, data on employment were used as a proxy for size of sector/industry in particular macro-regional thematic priority area.
Benchmarking of upstream (Scientific and RDI potential) of Innovation chain analysis is based on scientific production in designated fields, along with participation in FP7 and H2020 projects of relevant theme. Midstream and Downstream parts of Innovation chain analysis were benchmarked using data on KETs patents (midstream) and data on employment (downstream).

Main objective of the analysis is to evaluate/estimate the potential of AIR region along Innovation value chain in selected macro-regional thematic priority areas (MRTPAs) and provide valid support to the choice of thematic areas.

Conceptual framework for Innovation value chain analysis is borrowed from Radosevic and Walendowski\textsuperscript{192}, while modifications to it, come as a consequence of focusing on much more heterogeneous area and availability of datasets and tools needed for analysis.

Furthermore, benchmarking along Innovation value chain, on such a heterogeneous area, regarding levels of development (economic, technological, etc.) assumes that findings should serve as a guidance, not as a final verdict, in relation to the selected macro regional thematic priority areas.

\textsuperscript{192} Radosevic, S., Walendowski, J. (2016), op. cit.
15.1 Analysis of innovation value chain in AIR region (upstream – R&D excellence)

Analysis of scientific publication

Analysis of innovation chain in AIR region will start at the upstream part of innovation chain, by analyzing scientific publication production (number of scientific papers published) and their quality (number of citations).

Analysis is carried out on SCImago Journal & Country rank database, which consists of 27 broader scientific subject areas. For assessing regions scientific potential in each of the selected MRTPAs, subject area categories of the SCImago Journal & Country rank database were aggregated in manner illustrated in Table 22.

**Table 22 Scientific subject areas of SCImago database and their relation to MRTPA selected**

<table>
<thead>
<tr>
<th>SCImago JCR - scientific areas</th>
<th>MRTPA selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural &amp; Biological Sciences</td>
<td>Agro-bioeconomy</td>
</tr>
<tr>
<td>Biochemistry, Genetics and Molecular Biology</td>
<td>Energy &amp; Environment</td>
</tr>
<tr>
<td>Veterinary</td>
<td>Transport &amp; Mobility</td>
</tr>
<tr>
<td>Energy</td>
<td>Health &amp; Mobility</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>ICT</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
</tr>
<tr>
<td>Health Professions</td>
<td></td>
</tr>
<tr>
<td>Immunology and Microbiology</td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td></td>
</tr>
<tr>
<td>Pharmacology, Toxicology and Pharmaceutics</td>
<td></td>
</tr>
<tr>
<td>Computer Science</td>
<td></td>
</tr>
<tr>
<td>Arts and Humanities</td>
<td></td>
</tr>
<tr>
<td>Business, Management and Accounting</td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td></td>
</tr>
<tr>
<td>Decision Science</td>
<td></td>
</tr>
<tr>
<td>Dentistry</td>
<td></td>
</tr>
<tr>
<td>Earth and Planetary Science</td>
<td></td>
</tr>
<tr>
<td>Economics, Econometrics and Finance</td>
<td></td>
</tr>
<tr>
<td>Materials Science</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>Multidisciplinary</td>
<td></td>
</tr>
<tr>
<td>Neuroscience</td>
<td></td>
</tr>
<tr>
<td>Nursing</td>
<td></td>
</tr>
<tr>
<td>Physics and Astronomy</td>
<td></td>
</tr>
<tr>
<td>Psychology</td>
<td></td>
</tr>
<tr>
<td>Social Sciences</td>
<td></td>
</tr>
</tbody>
</table>


Table 23 illustrates scientific production per selected MRTPA. As it is visible from the table, highest scientific output is recorded in MRTPA of Health and Medicine, followed by similar scientific

---

OIS-AIR is implemented through the financial support of the ADRION programme
publication result in MRTPAs Agro-Bioeconomy and Transport and Mobility. MRTPAs Energy and Environment and ICT are, to a certain extent, characterized by lower scientific production.

**Table 23 Scientific papers per 1000 inhabitants**

<table>
<thead>
<tr>
<th>Documents per 1000 inhabitants</th>
<th>ICT</th>
<th>Transport and Mobility</th>
<th>Health and Medicine</th>
<th>Energy and Environment</th>
<th>Agro-Bioeconomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>0.1</td>
<td>0.1</td>
<td>0.4</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>0.4</td>
<td>0.6</td>
<td>1.0</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Croatia</td>
<td>1.9</td>
<td>3.8</td>
<td>7.7</td>
<td>1.7</td>
<td>4.5</td>
</tr>
<tr>
<td>Greece</td>
<td>4.3</td>
<td>4.9</td>
<td>9.2</td>
<td>2.3</td>
<td>4.8</td>
</tr>
<tr>
<td>Italy</td>
<td>2.8</td>
<td>4.1</td>
<td>9.5</td>
<td>1.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Montenegro</td>
<td>1.1</td>
<td>1.5</td>
<td>0.9</td>
<td>0.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Serbia</td>
<td>1.2</td>
<td>2.0</td>
<td>2.6</td>
<td>0.9</td>
<td>2.2</td>
</tr>
<tr>
<td>Slovenia</td>
<td>4.7</td>
<td>8.2</td>
<td>8.9</td>
<td>3.4</td>
<td>7.7</td>
</tr>
<tr>
<td>Average</td>
<td>2.1</td>
<td>3.2</td>
<td>5.0</td>
<td>1.4</td>
<td>3.3</td>
</tr>
</tbody>
</table>


Slovenia, came out as a leader in scientific production in all MRTPAs, except in MRTPA Health and Medicine, in which Italy has the highest level of scientific production. Strong performers in scientific production across all regions, beside Slovenia, are Italy, Greece and Croatia, whereas Serbia is lagging somewhat behind the leaders, and occupies the middle of the pack. At the bottom, considering scientific production are Albania, Bosnia and Herzegovina and Montenegro.

**Figure 55 Radar chart of scientific papers per 1000 inhabitants**

OIS-AIR Pilot of Adriatic-Ionian MRS3

Table 24 illustrates citations (self-citations excluded) of scientific publications by authors from AIR region. Number of citations, in general, should illustrate the quality of the scientific production. The higher number of citations is, the greater impact scientific publication has had on its subject area, and that translates into “greater quality” of scientific production.

**Table 24 Citations per 1000 inhabitants**

<table>
<thead>
<tr>
<th>Citations per 1000 inhabitants</th>
<th>ICT</th>
<th>Transport and Mobility</th>
<th>Health and Medicine</th>
<th>Energy and Environment</th>
<th>Agro-Bioeconomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>0.3</td>
<td>0.4</td>
<td>3.9</td>
<td>1.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>1.2</td>
<td>2.3</td>
<td>7.1</td>
<td>1.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Croatia</td>
<td>7.3</td>
<td>16.9</td>
<td>72.6</td>
<td>14.8</td>
<td>56.4</td>
</tr>
<tr>
<td>Greece</td>
<td>37.3</td>
<td>55.0</td>
<td>175.3</td>
<td>44.1</td>
<td>108.1</td>
</tr>
<tr>
<td>Italy</td>
<td>25.8</td>
<td>45.4</td>
<td><strong>205.9</strong></td>
<td>27.1</td>
<td>137.1</td>
</tr>
<tr>
<td>Montenegro</td>
<td>5.4</td>
<td>9.4</td>
<td>6.2</td>
<td>1.7</td>
<td>4.8</td>
</tr>
<tr>
<td>Serbia</td>
<td>5.0</td>
<td>10.5</td>
<td>23.8</td>
<td>6.2</td>
<td>16.8</td>
</tr>
<tr>
<td>Slovenia</td>
<td><strong>44.0</strong></td>
<td><strong>67.9</strong></td>
<td><strong>145.3</strong></td>
<td><strong>50.6</strong></td>
<td><strong>143.8</strong></td>
</tr>
<tr>
<td>Average</td>
<td>15.8</td>
<td>26.0</td>
<td>80.0</td>
<td>18.4</td>
<td>59.2</td>
</tr>
</tbody>
</table>


The highest citations results are again present in MRTPA Health and Medicine, followed by MRTPA Agro-Bioeconomy. Rest of the MRTPAs is lagging quite behind. Slovenia is at the top in quality of the scientific production measured through the citation scores, although Italy and Greece are almost at par with Slovenia. Croatia is lone in the middle, and Serbia is leading the lower part of distribution.

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193 Difference in average citations in different subject areas is to a certain extent, connected to a certain scientific publications practices within certain scientific fields.
In conclusion, summary of the findings regarding scientific production and quality of it, once again, are disclosing heterogeneous nature of the macro-region. Some stylized facts regarding analysis of scientific production can be highlighted in following manner:

1. Leaders in Scientific production and the quality of the same are: Italy and Slovenia.
2. Considering the scientific fields that match selected MRTPAs, highest scientific potential lies within MRTPAs of Health and Medicine and Agro-Bioeconomy.

Analysis of participation in FP7 and H2020 funded projects

Besides analysing bibliometric data, R&D capacities of the region are assessed through participation in FP7 and H2020 projects.

FP7 and H2020 are deemed as supportive of excellent science, therefore, participation on FP7 and Horizon 2020 projects in selected MRTPAs should provide us with valuable insights into AIR region RDI potential, beside mere bibliometric analysis.

Additionally, since FP7 and H2020, are pan European programmes that foster collaboration throughout European Union and beyond, participation in projects, could be seen as contribution to technology transfer in and out of the AIR region.

Data on FP7 and H2020 projects was structured in following manner:

1. projects were included into dataset on basis of two criteria:
2. projects coordinator or project partner are from AIR region
3. project theme is aligned with MRSTPAs theme

As it is visible from Table 25, percentage of partners from AIR region on FP7 and H2020 funded projects is lowest in the Transport and mobility MRTPA, whereas in Health and Medicine is the highest. Share of domestic partners (R&D organizations from AIR region) in projects points toward “knowledge and technology transfer” nature of collaboration, specifically in those MRTPAs where participation of “domestic” R&D organizations is the lowest (i.e. Transport and Mobility).

Table 25 Share of members of AIR in FP7 and H2020 projects per MRTPA

<table>
<thead>
<tr>
<th>% share of members from AIR</th>
<th>FP7</th>
<th>H2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport &amp; Mobility</td>
<td>19.6%</td>
<td>29.0%</td>
</tr>
<tr>
<td>Health &amp; Medicine</td>
<td>36.3%</td>
<td>46.8%</td>
</tr>
<tr>
<td>Agro-bioeconomy</td>
<td>42.8%</td>
<td>43.3%</td>
</tr>
<tr>
<td>Energy &amp; Environment</td>
<td>36.2%</td>
<td>26.3%</td>
</tr>
<tr>
<td>Tourism &amp; Culture (ICT)</td>
<td>42.5%</td>
<td>40.5%</td>
</tr>
</tbody>
</table>


Table 26 provide detailed representation of the FP7 projects participation per country of AIR region and MRTPAs. As it is visible, R&D organizations participated the most in projects under ICT theme, which in our case is proxy for MRTPA Tourism and Culture, since ICT is a key enabling technology regarding this MRTPA.\(^{194}\)

Besides ICT, second and third strongest results, considering participation in FP7 projects, are to be found in MRTPA Health and Medicine and MRTPA Energy and Environment. Results illustrated in Table 26 illustrate valid R&D potential per each of MRTPA selected in AIR region.

The fact that FP7 was a pan European programme, points toward opportunity for transfer of technology from other parts of EU and beyond through collaboration.

**Table 26 Participation in FP7 projects per MRTPA selected for AIR region**

<table>
<thead>
<tr>
<th>FP7</th>
<th>Transport and Mobility</th>
<th>Health and Medicine</th>
<th>Agro-Bioeconomy</th>
<th>Energy and Environment</th>
<th>Tourism and Culture (ICT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Greece</td>
<td>21</td>
<td>31</td>
<td>25</td>
<td>37</td>
<td>56</td>
</tr>
<tr>
<td>Croatia</td>
<td>5</td>
<td>9</td>
<td>12</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Italy</td>
<td>27</td>
<td>87</td>
<td>56</td>
<td>89</td>
<td>144</td>
</tr>
<tr>
<td>Serbia</td>
<td>5</td>
<td>6</td>
<td>10</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Slovenia</td>
<td>8</td>
<td>15</td>
<td>8</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Montenegro</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>341</td>
<td>419</td>
<td>269</td>
<td>478</td>
<td>550</td>
</tr>
</tbody>
</table>


Table 27 illustrates participation in H2020 projects per MRTPA of the countries belonging to the AIR region. Participation patterns in H2020 funded projects, roughly follows participation patterns from FP7 programme.\(^{195}\) MRTPA Agro-Bioeconomy is the MRTPA with most project participation from the AIR region, followed ICT (proxy for Tourism and Culture), Health and Medicine and Energy and Environment.

**Table 27 Participation in H2020 projects per MRTPA selected for AIR region**

<table>
<thead>
<tr>
<th>H2020</th>
<th>Transport and Mobility</th>
<th>Health and Medicine</th>
<th>Agro-Bioeconomy</th>
<th>Energy and Environment</th>
<th>Tourism and Culture (ICT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Greece</td>
<td>13</td>
<td>24</td>
<td>27</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>Croatia</td>
<td>1</td>
<td>11</td>
<td>13</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Italy</td>
<td>16</td>
<td>44</td>
<td>42</td>
<td>17</td>
<td>37</td>
</tr>
<tr>
<td>Serbia</td>
<td>2</td>
<td>13</td>
<td>18</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Slovenia</td>
<td>8</td>
<td>13</td>
<td>16</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Montenegro</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>OTHER</td>
<td>98</td>
<td>124</td>
<td>156</td>
<td>165</td>
<td>141</td>
</tr>
<tr>
<td>TOTAL</td>
<td>138</td>
<td>233</td>
<td>275</td>
<td>224</td>
<td>237</td>
</tr>
</tbody>
</table>


---

\(^{195}\) Horizon 2020 is still ongoing programme, therefore participation pattern is subject to change.
In conclusion, upper stream of Innovation chain of AIR region, which is assessed through analysis of scientific production and participation of R&D organizations in FP7 and H2020 funded projects, is assuring regarding R&D potential of the AIR region in selected MRTPAs.

Key findings can be summarized in following fashion:

1. Regarding scientific production and the quality of the scientific production MRTPA Health and Medicine is at the top of the pack, with strongholds in four EU member countries of AIR region.
2. Participation in FP7 and H2020 funded projects testify to equal results in all of MRTPAs, therefore pointing toward great R&D potential for selected MRTPAs within region.
3. FP7 and H2020 funded projects are to be seen, not just as supporting of excellent science in the region, but as “Knowledge and technology transfer” vehicle in and out of the AIR region.
Data on employment was grouped according to NUTS 2 regions and selected MRSTPAs. Aggregation of economic activities in order to define the scope of each of MRTPAs selected, is presented in Table 28. Data on employment were grouped according to description of the thematic priority areas of regional and national S3 (for EU countries) and on description of innovation/economic development documents (for non-EU countries) found in Eye@RIS3 tool.

Data on employment serve as a proxy for the size of sector/industry (in this case measuring the potential of macro-regional thematic priority area)

**Table 28 NACE Rev. 2 classification and its relation to MRTPAs selected**

<table>
<thead>
<tr>
<th>AGRO-BIOECONOMY</th>
<th>TRANSPORT &amp; MOBILITY</th>
<th>ENERGY &amp; ENVIRONMENT</th>
<th>HEALTH &amp; MEDICINE</th>
<th>TOURISM &amp; CULTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.01 Crop and animal production</td>
<td>C.27 Manufacture of electrical equipment</td>
<td>D.35 Electricity, gas, steam and air conditioning supply</td>
<td>C.21 Manufacture of basic pharmaceutical products and pharmaceutical preparations</td>
<td>I.55 Accommodation</td>
</tr>
<tr>
<td>A.02 Forestry and logging</td>
<td>C.29 Manufacture of motor vehicles, trailers and semi-trailers</td>
<td>E.36 Water collection, treatment and supply</td>
<td>C.26 Manufacture of computer, electronic and optical products</td>
<td>I.56 Food and beverage service activities</td>
</tr>
<tr>
<td>A.03 Fishing and Aquaculture</td>
<td>C.30 Manufacture of other transport equipment</td>
<td>E.37 Sewerage</td>
<td>Q.86 Human health activities</td>
<td></td>
</tr>
<tr>
<td>C.10 Food products</td>
<td>H.49 Land transport and transport via pipelines</td>
<td>E.38 Waste collection, treatment and disposal activities; materials recovery</td>
<td>Q.87 - Residential care activities</td>
<td></td>
</tr>
<tr>
<td>C.11 Beverages</td>
<td>H.50 Water transport</td>
<td>E.39 Remediation activities and other waste management services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.12 Tobacco</td>
<td>H.51 Air transport</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.16 Manufacture of wood and of products of wood and cork</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Thus, formed MRTPAs were then benchmarked to verify its potential of collaboration in Adriatic-Ionian region. Both data, on employment and KET patents, served to calculate Balassa indices of specialisation for each NUTS 2 region.

Balassa index of specialisation is often used in international economics for calculation of relative advantage of certain country/region evident in trade flows. In this case, Balassa index is used to reveal potential for cooperation in selected MRTPAs.

Table 29 illustrates the level of specialisation of NUTS 2 level regions and countries, regarding size of the sector/industry in selected MRTPAs.

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196 Balassa, B. (1965), *Trade Liberalization and Revealed Comparative Advantage*, Manchester School of Economic and Social Studies, 33, 99–123.
OIS-AIR Pilot of Adriatic-Ionian MRS3

Table 29 Balassa index of NUTS 2 level specialisation per MRTPA

<table>
<thead>
<tr>
<th>NUTS2</th>
<th>AGRO-BIOECONOMY</th>
<th>ADVANCED MANUFACTURING TECHNOLOGIES</th>
<th>ENERGY AND ENVIRONMENT</th>
<th>TRANSPORT &amp; MOBILITY</th>
<th>ICT AND ELECTRONICS</th>
<th>TOURISM AND CULTURE</th>
<th>HEALTH AND MEDICINE</th>
<th>SMART CITIES AND COMMUNITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatoliki Makedonia, Thraki</td>
<td>2.59</td>
<td>0.40</td>
<td>0.50</td>
<td>0.18</td>
<td>0.49</td>
<td>1.04</td>
<td>0.97</td>
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</tr>
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<td>0.36</td>
<td>0.98</td>
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<td>1.00</td>
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<td>1.18</td>
<td>1.33</td>
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<td>1.50</td>
<td>1.37</td>
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<td>1.71</td>
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<td>1.19</td>
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<td>0.99</td>
<td>0.89</td>
<td>0.71</td>
<td>0.91</td>
<td>0.89</td>
<td>0.98</td>
</tr>
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<td>Marche</td>
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<td>0.90</td>
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<td>0.85</td>
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<td>0.75</td>
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<td>0.65</td>
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<tr>
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<td>0.93</td>
<td>1.16</td>
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<td>1.05</td>
<td>1.07</td>
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<tr>
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<td>1.31</td>
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<td>0.81</td>
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<td>0.97</td>
<td>0.74</td>
<td>0.89</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Frequency 23 7 11 10 9 16 16 9

Most frequent among NUTS2

EUSAIR pillars


It is clear that five most suitable areas (MRTPAs) for collaboration within Adriatic-Ionian region, according to benchmark would be (in descending order):

1. Agro-Bioeconomy
2. Energy and Environment
3. Transport and Mobility
4. Tourism and Culture
MRTPA Agro-Bioeconomy

As it is visible from Table 30, according to benchmark exercise MRTPA Agro-Bioeconomy is most promising field of RDI cooperation in the Adriatic-Ionian region. Besides being potentially most promising filed of cooperation, it is widely represented in strategic documents of the countries and regions of the Adriatic-Ionian region. Although, it is not one of the pillars of EUSAIR, topics referring to MRTPA Agro-Bioeconomy are to be found in three out of four pillars of EUSAIR. Moreover, besides having great potential in sheer size of the industry/sector, availability of patents and R&D excellence in field of Industrial biotechnology emphasizes importance of this MRTPA selection.

Table 30 Agro-Bioeconomy (midstream and downstream benchmark)

<table>
<thead>
<tr>
<th>NUTS2</th>
<th>AGRO - BIO FOOD</th>
<th>KET specialization index (Ind. Biotech)</th>
</tr>
</thead>
<tbody>
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<td>3.934</td>
</tr>
<tr>
<td>Kentriki Makedonia</td>
<td>1.76</td>
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</tr>
<tr>
<td>Dytiki Makedonia</td>
<td>2.16</td>
<td>0.000</td>
</tr>
<tr>
<td>Ipeiros</td>
<td>2.92</td>
<td>4.080</td>
</tr>
<tr>
<td>Thessalia</td>
<td>2.19</td>
<td>1.107</td>
</tr>
<tr>
<td>Ionia Nisia</td>
<td>1.89</td>
<td>0.000</td>
</tr>
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<td>Sterea Ellada</td>
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<td>1.853</td>
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<td>Peloponnisos</td>
<td>3.18</td>
<td>0.000</td>
</tr>
<tr>
<td>Attiki</td>
<td>0.58</td>
<td>0.000</td>
</tr>
<tr>
<td>Voreio Aigaio</td>
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<td>0.000</td>
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<tr>
<td>Notio Aigaio</td>
<td>1.18</td>
<td>4.802</td>
</tr>
<tr>
<td>Kriti</td>
<td>2.65</td>
<td>0.000</td>
</tr>
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<td>Lombardia</td>
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<td>0.813</td>
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<td>Provincia Autonoma di Trento</td>
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<td>0.581</td>
</tr>
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<td>0.000</td>
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<td>1.064</td>
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<tr>
<td>Marche</td>
<td>0.81</td>
<td>0.649</td>
</tr>
<tr>
<td>Abruzzo</td>
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<td>0.495</td>
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<td>Molise</td>
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<td>0.490</td>
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<td>Puglia</td>
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<td>1.304</td>
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<td>1.307</td>
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<tr>
<td>Sicilia</td>
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<td>0.467</td>
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<tr>
<td>Croatia</td>
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<td>2.069</td>
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<tr>
<td>Slovenia</td>
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<td>1.704</td>
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</tbody>
</table>

MRTPA Energy and Environment

Table 31 illustrates the state of the art in the selected MRTPA Energy and Environment. Although, it not as promising, considering sheer size of the sector, it is crucial MRTPA according to EUSAIR and many TPAs of S3 in the Adriatic-Ionian region. Furthermore, availability of KET patents and RDI excellence in the region could prove beneficial to stronger development of the MRTPA in question.

Table 31 Energy and Environment (midstream and downstream benchmark)

<table>
<thead>
<tr>
<th>NUTS2</th>
<th>ENERGY AND ENVIRONMENT</th>
<th>KET specialization index (Adv. Mat.)</th>
<th>KET specialization index (Nanotechnology)</th>
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<td>0.307</td>
<td>0.000</td>
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<tr>
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<td>1.13</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Iperios</td>
<td>0.73</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Thessalia</td>
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<td>0.804</td>
<td>0.000</td>
</tr>
<tr>
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<td>8.802</td>
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<td>4.314</td>
</tr>
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<td>0.61</td>
<td>2.627</td>
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</tr>
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<td>Peloponnisos</td>
<td>0.58</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Attiki</td>
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<td>3.788</td>
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<td>Voreio Aigaio</td>
<td>0.42</td>
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<td>0.000</td>
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<tr>
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<td>0.39</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Kriti</td>
<td>0.48</td>
<td>1.089</td>
<td>1.728</td>
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<tr>
<td>Lombardia</td>
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<td>Slovenija</td>
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<td>0.717</td>
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</table>

MRTPA Transport and Mobility

Table 32 represents benchmark of downstream (sector size) and midstream (KET patents) for MRTPA Transport and Mobility. It is visible that this industry/sector is strong mainly in Northern Italy and Slovenia, whereas rest of the region is less specialized in that area. Nonetheless, inclusion of MRTPA Transport and Mobility in MRS3 is based on its overwhelming presence in EUSAIR and in TPA of S3 of the regions/countries of the Adriatic-Ionian region.

Table 32 Transport and Mobility (midstream and downstream benchmark)

<table>
<thead>
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<th>KET specialization index (Adv. Mat.)</th>
<th>KET specialization index (Mi.-Na. Elec.)</th>
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<td>3.494</td>
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<td>0.660</td>
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<td>Calabria</td>
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<td>Sicilia</td>
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<td>0.336</td>
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<td>Croatia</td>
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<tr>
<td>Slovenia</td>
<td>1.31</td>
<td>0.717</td>
<td>0.565</td>
</tr>
</tbody>
</table>

MRTPA Tourism and Culture

Table 33 represents benchmark of downstream (sector size) and midstream (KET patents) for MRTPA Tourism and Culture. It is visible that this industry/sector is strong mainly in Greece and Northern Italy and Croatia, as expected. Rest of the region is less specialized in that area. Nonetheless, inclusion of MRTPA Tourism and Culture, in MRS3 is based on its representation in EUSAIR and in TPA of S3 of the regions/countries of the Adriatic-Ionian region.

Table 33 Tourism and Culture (midstream and downstream benchmark)

<table>
<thead>
<tr>
<th>NUTS 2</th>
<th>NACE</th>
<th>TOURISM AND CULTURE</th>
<th>KETs</th>
<th>Photonics</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1.04</td>
<td></td>
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</tr>
<tr>
<td>Kentriki Makedonia</td>
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<td></td>
<td>0.62</td>
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</tr>
<tr>
<td>Dytiki Makedonia</td>
<td>0.99</td>
<td></td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Ipiros</td>
<td>1.50</td>
<td></td>
<td>0.00</td>
<td></td>
</tr>
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<td>Thessalia</td>
<td>1.06</td>
<td></td>
<td>0.00</td>
<td></td>
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<tr>
<td>Ionia Nisia</td>
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<td></td>
<td>0.00</td>
<td></td>
</tr>
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<td>Dytiki Ellada</td>
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<td></td>
<td>0.65</td>
<td></td>
</tr>
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<td>Sterea Ellada</td>
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<td>Peloponnisos</td>
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<tr>
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<td>Emilia-Romagna</td>
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<td>Umbria</td>
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<tr>
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<tr>
<td>Abruzzo</td>
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<tr>
<td>Molise</td>
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<tr>
<td>Puglia</td>
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<td>Calabria</td>
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MRTPA Health and Medicine

Table 34 illustrates the state of the art in the selected MRTPA Health and Medicine. Considering sheer size of the sector, and importance assigned to it by being fourth most frequent TPA of S3 in the Adriatic-Ionian region, Health and Medicine makes a good choice mutual collaboration area for Adriatic-Ionian region. Furthermore, availability of KET patents and RDI excellence in the region could prove beneficial to stronger development of the MRTPA Health and Medicine.

Table 34 Health and Medicine (midstream and downstream benchmark)

<table>
<thead>
<tr>
<th>NUTS 2</th>
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<th>KETs</th>
<th>Nanotechnology</th>
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</tr>
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<td>Abruzzo</td>
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<td>Molise</td>
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</tbody>
</table>

CONCLUSION

Analysis of potential for future growth of selected MRTPAs along Innovation chain, proved that proposing selected areas for MRTPAs of MRS3 was a sound choice. Findings can be summarized through following stylized facts:

1. Heterogeneous nature of ADRON region is obvious all along innovation value chain.
2. Leading countries and regions tend to specialise in sectors of Energy and Environment and Transport and Mobility, whereas those that are lagging behind some, tend to have specialisation in Agro-Bioeconomy and Tourism and Culture.
3. There is substantial expertise and R&D potential in the region, primarily in the Health and Medicine area.
4. Agro-Bioeconomy as most frequently chosen specialisation among AIR countries and regions confirmed its potential in sheer size of the sector as well as in RDI potential.
5. Tourism and Culture, although generally non-R&D innovation driven, is seizing up a quite large share of economic activity in the countries and the regions of AIR macro-region.

NOTE:

Due to unavailability of the data for some countries (Albania, Montenegro, Serbia and Bosnia and Herzegovina), certain parts of analysis are carried out on limited sample of countries and regions of AIR macro-region.
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